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Rasch (W.). **Vorratsschädlinge an Bord und im Lagerhaus.** [Pests of Stored Products on Board and in the Storehouse.]—71 pp., 30 figs., 14 refs. Frankfurt am Main, the Author, 1956.

This pamphlet was compiled in view of the high rate of infestation of stored products in Germany, particularly foodstuffs in transit in ships through coastal or inland waterways or imported from overseas. The matter is divided into two parts. The first contains a general introduction, in which the extent of the problem and the measures adopted in other countries are briefly reviewed, followed by sections on the recognition of infestation and the sites most affected, both on ships and in storehouses, the mode of life of insects and mites, and information on measures for the prevention and control of infestation in loaded, partly loaded and empty ships and in silos and storehouses. The second part contains descriptions of the principal insects and mites concerned, with notes on their bionomics and the products attacked.

Hurpin (B.). **Études sur le déterminisme des sorties pré-alimentaires du hanneton.**—*Rev. Zool. agric.* **54** no. 7–9 pp. 85–87, 1 fig., 2 refs. Talence, 1955.

In tests in northern France to determine whether adults of *Melolontha melolontha* (L.) are induced to move towards the surface of the soil on emergence from their winter diapause by the higher temperature at the surface, the author used an apparatus incorporating a small barrel containing soil, the temperature of which ranged from about 20°C. [68°F.] at the base to 5°C. [41°F.] at the surface. Field-collected adults that had not yet flown were placed in the soil half way down, at about 13°C. [55·4°F.], and records were made of the temperatures at which they were found after some 2–3 days. In two of three tests, the beetles migrated upwards in spite of the lower temperature (some having had their antennae removed and others their eyes varnished), but in the third, almost all moved downwards. These latter had, however, been kept in a cold-room for considerably longer than the beetles used in the other tests. It is concluded that the adults are induced to move to the surface by negative geotropism and not by higher soil temperatures, and this view was supported by field observations in 1950, large numbers leaving the soil at a time when the temperature was lower at the surface than at a depth of 10 ins.

Hartzell (A.). **Two new Hosts of *Matsucoccus* Bark Scale.**—*Contr. Boyce Thompson Inst.* **18** no. 6 pp. 281–282, 1 ref. Yonkers, N.Y., 1956.

As red pines (*Pinus resinosa*) growing in an arboretum in New York were found to be infested by *Matsococcus resinosae* Bean & Godwin [*cf. R.A.E.*, A **44** 274], an investigation on the food-plant range of this Coccid was begun. Attempts were made to infest 22 mainly exotic species of pine by tying infested twigs of *P. resinosa* to the outer branches in June 1954 and June and August 1955, when crawlers were present, and allowing them to remain until the end of the growing season. No infested trees were found in the autumn of 1954, but a Japanese red pine (*P. densiflora*) and a Chinese pine (*P. tabulaeformis*), which had both been exposed to infestation in the two years, were found to be infested with nymphs in November 1955. None of the other species was attacked.

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Schreier (O.) & Russ (K.). **Über den Massenwechsel von *Doralis fabae* Scop. und *Myzodes persicae* Sulz. und seine Bedeutung für das Auftreten der virösen Rübenvergilbung in Österreich.** [On Fluctuations in Populations of *Aphis fabae* Scop. and *Myzus persicae* Sulz. and their significance for the Occurrence of Beet Yellows in Austria.]—*Pflanzenschutzberichte* **13** pt. 1–3 pp. 1–43, 10 figs., 27 refs. Vienna, 1954. (With a Summary in English.)

A detailed account is given of observations on sugar beet growing at an experiment station in Lower Austria in 1953 to determine the course of infestation by *Aphis* (*Doralis*) *fabae* Scop. and *Myzus* (*Myzodes*) *persicae* (Sulz.), the two Aphids held responsible for the spread of the yellows virus disease [*cf. R.A.E.*, A **42** 65]. Most of the work was done in a field sown on 30th March, and two methods of counting were adopted. In the first, whole plants in sample lengths of row were examined weekly, and in the second, the field was divided into plots and 90 green leaves and later 30 yellow leaves examined from each, also weekly.

Examination of whole plants showed that infestation and reproduction by immigrant alates of *A. fabae* had begun by 11th May and that about 4 per cent. of the plants were infested by the end of that month. The attack then increased rapidly, until 70 per cent. of the plants were infested by 1st July. The infestations were classified as isolated Aphids distributed singly over the leaf, colonies covering an area of not more than 0·25 sq. cm., and larger colonies, and the numbers of these per 100 plants were about 70, 90 and 20, respectively, on 1st July. Apterae of *A. fabae* were frequently observed to migrate from heavily infested plants to neighbouring ones with little or no infestation. The percentage of mature and immature alates in the colonies was 7 on 28th May, about 5 on 6th June and about 10 on 2nd July, but the attack declined rapidly from 1st until 20th July, and the field was then practically free from the Aphid until the end of August. A second but much slighter outbreak of *A. fabae* occurred from the beginning of September until the end of October, reaching its height between 7th and 21st September, but not more than about 5 per cent. of the plants were infested and no large colonies were observed. *M. persicae* was not recorded until 1st June, when reproduction had begun. Two population peaks occurred, almost concurrently with those of *A. fabae*, but the first was very low and large colonies occurred at no time. The numbers of mature and immature alates reached a maximum in mid-June and again on 2nd July, after which infestation decreased. By 31st August, 71·4 per cent. of the plants had been infested by *A. fabae* alone, 2·8 per cent. by *M. persicae* alone and 1 per cent. by both species simultaneously, and the corresponding percentages at the end of the second period of infestation were 8·6, 28·2 and 1·3, respectively. The estimated ratio between *M. persicae* and *A. fabae* was 1:1,000 during the first peak and 1:0·7 during the second, but as *M. persicae* had been rare on sugar beet in 1952 [*cf. loc. cit.*], it is concluded that its preponderance in the autumn of 1953 was exceptional. In subsidiary observations, few colonies of either Aphid were found on 29th September in a field sown on 25th July and none on 25th October, and none occurred on either date in one sown on 7th September.

The examination of individual leaves between 28th May and 20th October showed that the average numbers of infestations by isolated examples of *A. fabae* and (in brackets) *M. persicae* per 100 leaves were 12·8 (3·7), 6·4 (1) and 4 (0·5) on the outer, middle and inner leaves, respectively, and that the numbers of small colonies averaged 14·5 (0·1) on the outer leaves and 12·8 (0·7) on the middle and inner leaves. Large colonies of *A. fabae* averaged 1·1 per 100 leaves on the outer and 1·9 on the middle and inner leaves. The percentages of green and yellow leaves on which

examples of *A. fabae* and (in brackets) *M. persicae* were distributed singly were 22·9 (34·9) and 24·8 (91·4), respectively, and the percentages of those on which small colonies were found were 10·9 (3·1) and 14·1 (21·5), respectively.

Symptoms of virus yellows were first observed on 6th July, and fresh infestations appeared until 21st September. A comparison between the weekly percentages of plants infested by Aphids and those showing yellows symptoms indicated that infestation by *A. fabae* and infection with yellows were largely parallel in development, the incubation period of the disease being estimated to last three weeks. Further calculation showed that 4·5 per cent. of the plants became infested by *A. fabae* at least three weeks before the appearance of yellows symptoms on them, but no such relation could be established with *M. persicae* or both Aphids together. In all, 10·1 per cent. of the plants developed yellows symptoms without previous infestation or in less than three weeks after infestation, and the percentages of those that did not become infected but were infested by *A. fabae*, *M. persicae* or both Aphids were 62·5, 1·5 and 2·4, respectively. The plants infested by *A. fabae* and those showing yellows symptoms were predominantly and fairly evenly distributed along the edges of the field, being slightly more numerous along the west edge, which was the one exposed to the prevailing wind, and infestation by *M. persicae* was also concentrated along the west edge.

As beet grown for seed is known to be an important source of the virus, additional observations were carried out on seed crops near Vienna and in Lower Austria between 9th and 15th May. These showed that all of 14 fields of beet grown from seed and 20 of 22 fields grown from stecklings were infested by *A. fabae*. The most likely source of infection for the experimental field was a field of seed beet just over three miles north-west of it. This field was not infested by *A. fabae* until 9th May and the infestation rapidly disappeared after reaching a low peak on 25th June, so that it is not considered to have been responsible for the infection in the experimental field.

In experiments with yellow trap dishes [*cf.* 41 8, etc.] and larger yellow or green square cups, nearly four times as many alates were caught per unit surface area in the yellow dishes as in the yellow cups, although more were caught per cup than per dish, and the number of those trapped in the green cups was only about one quarter of that for the yellow cups. In a field in which two trap dishes had been exposed 18 ins. above the ground, the first alates were caught on 18th May, and the catches reached peaks concurrently with those recorded from examination of the plants. Dishes set out in autumn caught fewer Aphids in beet fields sown in September than in those sown in April or July. Mass flights of *M. persicae* were observed at dusk on 29th September and again on 19th October, but the numbers caught in the dishes showed no corresponding increase. An attempt to set up an Aphid warning service in 1953 based on the use of the trap dishes proved unsuccessful, as the Aphids were generally present in the plants before they were caught in the dishes. The only natural enemy observed was *Coccinella septempunctata* L., but it afforded little reduction in population.

In control experiments, beet sown on 30th March was sprayed with Systox [diethyl 2-(ethylmercapto)ethyl thiophosphate (demeton)], at the rate of about 160 cc. in 27 or later 36 gals. water per acre, weekly from 13th May, when the plants reached the two-leaf stage, until 7th October, weekly from 13th May until 29th June, when *A. fabae* had reached its peak, on 20th and 27th May and 18th June, or on 18th June only. As compared with an adjusted figure of 100 for untreated plants, the numbers of treated plants that became infected with virus yellows up to 6th October and (in brackets) infested by Aphids up to 15th September were 55·5 (8·3), 78·1 (9),

103·1 (20·9) and 81·9 (32·2), respectively, and the corresponding numbers of infestations by single Aphids and (in brackets) colonies were 12·5 (2·3), 13·4 (1·8), 27 (14·9) and 40 (16·1).

Mathys (G.). **Contribution éthologique à la résolution du complexe *Bryobia practiosa* Koch (Acar., Tetranych.).**—*Mitt. schweiz. ent. Ges.* **27** pt. 2 pp. 137–146, 6 figs., 10 refs. Lausanne, 1954.

Field observations and food-plant tests in French Switzerland showed that *Bryobia practiosa* Koch was represented there by at least four biological races [*cf. R.A.E.*, A **31** 364]. One of them occurred on apple, pear and occasionally stone fruits and could not be reared on gooseberry, ivy (*Hedera helix*) or herbaceous plants. Only the eggs overwintered, and these were laid in the crowns of the trees, mainly on the bark of branches. Six summer generations were observed in 1952, and there are probably seven in favourable years. The winter eggs hatched at the beginning of April, and the first summer eggs were laid from 10th May onwards and hatched in 12 days on the average. The nymphs reached the adult stage in about ten days. There was little tendency to migrate from tree to tree. A second race, which had only one generation a year, occurred on gooseberry. Only the eggs overwintered, on the food-plant, and they hatched from the beginning of March, the adult population reaching a peak about 10th May. This race proved able to colonise fruit trees and herbaceous plants, but migrated from the latter when not caged, and did not survive on ivy. A third race occurred on ivy and could not be reared on the other test plants. It had 6–8 generations a year, and all stages were present together. Development ceased when the temperature fell below about 0°C. [32°F.] but there was no true diapause. The fourth race, which may itself be a complex, overwintered in all stages, but mostly in the egg, in dry, sheltered sites provided by walls, tree trunks, houses, etc. Hatching began in March, and the immature mites migrated to herbaceous plants. Several generations occurred during the summer, and some of the adults of all of them, increasing in number as the season advanced, returned to the sheltered sites to lay winter eggs. Individuals of the summer generations occasionally migrated to fruit trees, but this race could not be reared on gooseberry or ivy.

Martignoni (M. E.). **Über zwei Viruskrankheiten von Forstinsekten im Engadin.** [Two Virus Diseases of Forest Insects in the Engadine.]—*Mitt. schweiz. ent. Ges.* **27** pt. 2 pp. 147–152, 7 figs., 15 refs. Lausanne, 1954. (With a Summary in English.)

The two diseases referred to were observed in 1953, in the course of investigations on an outbreak of *Enarmonia* (*Eucosma*) *griseana* (Hb.) on larch in the Engadine, in north-eastern Switzerland. One of the causal viruses, which is referred to the genus *Bergoldia*, caused a granulosis disease of the larvae of *E. griseana*, and the other, referred to the genus *Borrelina*, caused a polyhedral disease of the larvae of *Oporinia autumnata* (Bkh.), which frequently accompanies *E. griseana*. The histopathological changes observed in the infected insects are described, and notes are given on the granules and polyhedra observed.

Vago (C.) & Cayrol (R.). **Une virose à polyèdres de la noctuelle gamma *Plusia gamma* L. (Lepidoptera).**—*Ann. Epiphyt.* **6** (1955) no. 4 pp. 421–432, 3 figs., 16 refs. Paris, 1956.

Investigations were carried out in France in 1951–54 on a disease that frequently causes sudden reductions in populations of larvae of *Autographa*

(*Plusia*) *gamma* (L.), an important pest of flax, beet and vegetable crops. The studies showed it to be a polyhedral disease of the nuclear type caused by a virus referable to the genus *Borrelina*. The macroscopic and microscopic symptoms are described. Various tissues were infected, including the fat-body, blood cells and Malpighian tubes, and in particular the epidermal and peritracheal cells. Larvae in all instars were affected, but mortality did not exceed about 15 per cent. in those in the first two, though it was sometimes complete in the third and fourth. Larvae that became infected when almost full-fed pupated in some cases but did not give rise to adults. At 20°C. [68°F.], symptoms appeared on the fourth day when haemolymph from infected larvae was injected into the body cavity of healthy larvae. When young, healthy larvae were fed individually on contaminated leaves, more than 60 per cent. became infected, but when the larvae were allowed to feed in groups, according to the usual method, infection rarely exceeded 10 per cent. The virus remained active for at least 12 months in dead larvae, and also after slow drying at 20°C.

Virtually all the larvae in a field of flax examined in June 1951 were found to have been destroyed by the disease. In field-cage tests, larvae originating from field-collected adults in September suffered 34 per cent. mortality, the disease becoming apparent in the last instar, and infection was complete among similar larvae mostly in the third and fourth instars, in November, though some did not die until the following April. When 12 successive generations were reared in the laboratory between July 1951 and March 1953 from adults collected in the field, the disease appeared in the second generation and was common in and after the fourth. In tests on factors inducing the virus to change from a latent to an active state, some activation was caused by feeding on leaves treated with a 0·1 per cent. solution of sodium fluoride and rather less by confining the larvae with almost no ventilation and a relative humidity of 95–98 per cent., though it was irregular in both cases. To investigate the effect of food-plants in activating the virus, larvae were reared on cabbage, *Plantago media* or *Sonchus arvensis*. During December 1951, all the larvae reared on cabbage died as a result of the disease, as compared with 20 per cent. infection among those on *Sonchus*. In the autumn of 1952, the disease affected 60–100 per cent. of the larvae reared on cabbage and less than 60 per cent. of those on *Plantago*. When some larvae were transferred in the third instar from *Plantago* to cabbage, all developed the disease, while there was no increase among those not transferred. In January 1952, when larvae were reared on *Plantago* grown in a greenhouse or on field-collected plants that had some tough leaves, the rate of development was roughly comparable, but the percentages that became diseased were 20 and 88, respectively. When larvae were reared on old leaves, young leaves and those of an intermediate age, the percentages that developed the disease were 25, 84 and 5, respectively, the symptoms appearing in the fifth, mainly in the third and in the fifth instar, respectively. The percentage mortality as a result of the disease among fourth-instar larvae reared on leaves of beet affected by mildew was 94, as compared with 4 among those reared on healthy beet.

Bonnemaison (L.) & Missonnier (J.). **Recherches sur le déterminisme des formes estivales ou hivernales et de la diapause chez le psylle du poirier** (*Psylla pyri* **L.**).—*Ann. Epiphyt.* **6** (1955) no. 4 pp. 457–528, 37 figs., 34 refs. Paris, 1956.

Detailed studies on the factors that determine the appearance of the summer and winter forms of Psyllids were begun near Paris in 1949 on *Psylla pyri* (L.), the only species common on pear in that region [*cf. R.A.E.*,

A **41** 98]. Descriptions are given of the wings and reproductive organs of the adults of both sexes of both the summer and winter forms. Females of the summer form begin to oviposit from the fourth day after emergence, whereas those of the winter form pass through a diapause before pairing and ovipositing.

The appearance of the winter forms was independent of the number of generations a year, since in 1949, when there were five generations (adult emergence beginning on 1st May, 10th June, 10th July, 10th August and 21st September, respectively), some appeared in the fourth generation, and in 1950, when there were four generations (emergence beginning on 1st May, 12th June, 3rd August and 4th September), some appeared in the third. In each year from 1949 to 1953, however, the first winter forms were observed between 2nd and 8th September. Preliminary experiments carried out in the laboratory at 14–20°C. [57·2–68°F.] showed that winter forms appeared when the nymphs were exposed to 12 hours or less natural or artificial daylight per day, and that it was possible to obtain a continuous succession of either winter or summer forms by regulating the photoperiod. It was possible by the same means to shorten the duration of the diapause and to obtain forms that were morphologically intermediate between the winter and summer ones but had no diapause, though there was in some cases a slight delay before oviposition. Only intermediate forms were produced in a further experiment at 16·5°C. [61·7°F.], in which the daily photoperiod was 13½ hours. When the nymphs were kept permanently in darkness (at 16 or 22°C. [60·8 or 71·6°F.]), the percentage of summer forms and intermediates tended to increase. The light intensity in most of these tests was 300 lux or less, and the Psyllid was found to be sensitive to very low intensities.

Tests were then carried out in which the nymphs were exposed to photoperiods of 12 or 16 hours in the various instars. The production of winter forms was greatest when the third- and fourth-instar nymphs were exposed to a photoperiod of 12 hours, and it was in these instars that the form of the adults was determined. Fewer winter forms with considerable numbers of intermediates were produced when only the fourth and fifth instars were exposed to photoperiods of 12 hours, and winter forms were not produced when the exposure to 12 hours occurred in the fifth instar only or when the fifth instar was subjected to the longer photoperiod. Nymphs that were the progeny of summer forms were found to be more sensitive to photoperiods of 12 hours in the early instars than those descended from winter forms. For all the adults to be of the summer form, it was necessary for nymphs that were the progeny of summer forms to be exposed to a photoperiod of 16 hours in all but the third, fourth, or fifth instar, and for nymphs descended from winter forms to be exposed to 16 hours daily in the fourth and fifth instars. Under optimum conditions, adults of either form were more readily obtained from nymphs descended from the other. Virtually all the adults obtained from nymphs that were the progeny of summer forms and were reared at temperature below 20°C., with exposure to light for 12 hours or less per day, were of the winter form; however, when the progeny of winter forms were reared under the same conditions, winter, summer and intermediate forms resulted. When nymphs descended from either form were reared at 14–25°C. [77°F.] and exposed to light for 16 hours per day, all the adults were of the summer form.

In two tests carried out at 16 and 17·4°C. [63·32°F.], to determine whether photoperiod exerted any indirect influence through its effect on the photosynthesis of the food-plant, young pear trees were exposed to light for 16 hours daily. Some of the nymphs on them (descended from the winter form) were exposed to light for the full 16 hours, and twigs bearing others were covered with light-proof bags after 12 hours. The nymphs gave rise

to 100 per cent. summer forms and 60–74 per cent. winter forms, respectively, indicating that both can appear on the same tree, accordingly as the twigs or leaves bearing them are exposed to the light. There was no evidence of a more direct influence of the food-plant on the form of the adults.

Investigations were also made on the factors affecting the diapause. The results showed that a state of prediapause is determined at the time of the fourth moult, and the diapause itself involved both the fifth-instar nymph and the adult, continuing until the ovaries of the females are in an advanced stage of development. The diapause was shortened by exposure to light in the adult stage for 16 hours daily (and to a lesser degree by exposure to 8 or 4 hours), and also by continued low temperatures, but high temperatures prolonged it. Exposure for 12 hours daily was the least favourable for the beginning of oviposition. Similar results were observed when fifth-instar nymphs were subjected to these conditions, though exposure to 16 hours' light per day had less effect. It appeared that when a single factor operated during both the fifth instar and the adult stage, its influence on the diapause was relatively greater than if it had operated on one stage only. When diapause individuals descended from winter forms were kept during the last instar and the adult stage under conditions favouring a shortening of the diapause (a photoperiod of 16 hours and an average temperature of 18°C. [64·4°F.]), oviposition began 17 days after the fourth moult, as compared with the 14 days for adults of the summer form, the diapause having been almost completely eliminated.

Under natural conditions, the duration of the diapause was longest for females that appeared early in the autumn and shortest for those that appeared towards the end of it, the combined effect of progressive reductions in the hours of daylight and in temperature on the fifth-instar nymphs inducing a shortening of the diapause; females that did not appear until December or January were able to oviposit after only a few days. From mid-December, all females were able to oviposit within 5–15 days of transfer to 17°C. [62·6°F.].

Hurpin (B.). **Développement des larves du hanneton** *Melolontha melolontha* **L. (Coleopt. Scarabeidae) à différentes températures constantes.**—*Ann. Epiphyt.* **6** (1955) no. 4 pp. 529–534, 1 graph, 10 refs. Paris, 1956.

The preliminary results are given of studies begun in 1952 in which larvae of *Melolontha melolontha* (L.) were reared individually in soil in the laboratory at constant temperatures ranging from 7 to 34°C. [44·6–93·2°F.], food being provided. The first instar averaged nine weeks at 20°C. [68°F.] and longer at 15°C. [59°F.], and these were the only temperatures at which it was completed. The second and third instars were shortest, averaging 7 and 23 weeks, respectively, at 25°C. [77°F.], but mortality was high and the optimum was at about 20°C., at which they averaged 14 and 32 weeks each. Second-instar larvae moulted at 11–25°C. [51·8–77°F.], and pupation occurred at 15–25°C. When the results were plotted on a graph, the thresholds of development appeared to be 12, 10 and 9°C. [53·6, 50 and 48·2°F.] for the three instars, respectively.

Graham (K.). **Notes on a Polyhedral Disease of Black-headed Budworm.**—*Canad. Ent.* **86** (1954) no. 12 pp. 546–548, 4 figs., 1 ref. Ottawa, 1955.

Notes are given on the symptoms and microscopic characteristics of a polyhedral disease of *Acleris variana* (Fern.) that was the most important single factor responsible for the decline of an outbreak of this Tortricid in

forests in British Columbia during 1940–45 [*cf. R.A.E.*, A **34** 377]. The disease was observed in larvae of both sexes in every instar except the first and also in the pupae, but no pathological symptoms occurred in the adults although the disease is transmitted through the egg [*cf.* **34** 379]. As a result of infection, the larvae became sluggish, swollen and ash-grey in colour, the tissues of both larvae and pupae liquefied, and the skin became fragile. The tissues most usually affected were the hypodermis and fat-body, but the blood and muscle cells, the tracheal matrix and the pericardium were also sometimes attacked.

Fisher (R. W.) & Smallman (B. N.). **Studies on a direct Feeding Method for Use in Bioassay of Insecticide Residues.**—*Canad. Ent.* **86** (1954) no. 12 pp. 562–569, 4 graphs, 3 refs. Ottawa, 1955.

A description is given of a method of rearing adults of *Drosophila melanogaster* Mg. on canned custard pumpkin by a modification of a technique already noticed [*R.A.E.*, A **39** 400], together with an account of studies on factors affecting their use for the bioassay of chlorinated-hydrocarbon insecticides. Aldrin was the toxicant selected. The adults were introduced into tubes containing pieces of filter paper bearing an even layer of pumpkin macerated with serially diluted water suspensions prepared from a 0·05 per cent. solution of aldrin in acetone, and the numbers dead or weakened and trapped in the condensation moisture in the tubes were recorded 20–24 hours later. The most reliable results were obtained by using equal numbers of males and females two days old, and the sex ratio of the parents did not affect the susceptibility of the progeny. In tests to determine the most effective number of adults per tube, as few as 8–10 gave excellent regression lines, but when 18–20 were present, many received only a sublethal dose. By using several tubes for each dosage of aldrin, the total number of flies per dosage could be increased without the ill-effects of overcrowding. It was found that when the adults in a darkened chamber were attracted by light through a small exit into the tubes, they emerged in groups composed entirely or almost entirely of one sex; they had therefore to be identified as to sex and placed in the tubes individually.

In bioassays of a known quantity of aldrin added to pumpkin, the most accurate result was given by five replicates of 15 adults of unknown sex. The estimates obtained from two replicates of 30 and five of 15 mixed adults and from three replicates of five males and five females were rather too high; the three replicates proved satisfactory, however, and involved less labour than five of 15 adults. Valid estimations were made at aldrin levels of 0·05 part per million. When the method was used to estimate dieldrin residues in samples of canned apple sauce prepared from fruit from sprayed and unsprayed trees and three replicates of 30 adults were used for each dosage, the large number of flies reduced the sensitivity of the test, but the order of the estimated residues agreed with that of the dosages applied to the trees.

Rabkin (F. B.) & Lejeune (R. R.). **Some Aspects of the Biology and Dispersal of the Pine Tortoise Scale,** *Toumeyella numismaticum* **(Pettit and McDaniel) (Homoptera: Coccidae).**—*Canad. Ent.* **86** (1954) no. 12 pp. 570–575, 2 figs., 5 refs. Ottawa, 1955.

In view of the current importance of *Toumeyella numismatica* (Pettit & McDaniel) [*cf. R.A.E.*, A **20** 172; **29** 605] on conifers in Manitoba and the United States, an account is given of observations on this Coccid carried out in 1937–38 in a forest reserve in Manitoba, where it had been of sporadic

importance since 1935. The trees attacked were *Pinus banksiana*, *P. sylvestris* and *P. resinosa*; young trees in plantations and natural stands were the most frequently attacked, and the damage caused was sometimes severe. Only the females overwintered, and they resumed development in spring when the buds of *P. banksiana* began to swell and the terminal shoots to lengthen. They produced copious honeydew, on which, in the absence of ants, a sooty mould develops. Honeydew was first observed on 15th May in 1938. The average number of eggs found in 19 mature or almost mature females that were dissected was 534. Oviposition began shortly after mid-June, and the eggs hatched in a few hours. The nymphs settled on the twigs and branches, showing some preference for the young growth. They were first noted on 21st June, and feeding was general by 7th July. The sexes can be distinguished after two weeks, and the males become mature a week later; the first adult males were observed on 3rd August, and they rarely survived for more than two days in the laboratory. Males and females appeared in approximately equal numbers. The females were fertilised while still immature and continued to develop until late September.

From collections made by means of adhesive traps exposed at heights of 3–80 ft. from 21st June to 28th August, it is concluded that the newly hatched nymphs are carried by air currents for distances of up to three miles; they were also found to migrate to a limited extent from tree to tree, and they may possibly be carried by birds, squirrels and insects.

URQUHART (F. A.). **A new Locality Record for the Termite in Ontario.**—*Canad. Ent.* **86** (1954) no. 12 p. 576. Ottawa, 1955.

The author records the existence of a permanent and apparently isolated population of *Reticulitermes flavipes* (Koll.) in Kincardine, Bruce County, Ontario [*cf. R.A.E.*, A **43** 73], where examples were collected from beneath rubbish in September 1954.

KIRKPATRICK (T. W.). **Notes on minor Insect Pests of Cacao in Trinidad.**—*Rep. Cacao Res. Trinidad 1952* pp. 62–71, 12 refs. St. Augustine, Trinidad, 1953 [issued 1954]. **Part 2. Lepidoptera (Butterflies and Moths).**—*Op. cit. 1953* pp. 67–72, 6 refs. 1954.

Selenothrips rubrocinctus (Giard) and *Steirastoma breve* (Sulz.) (*depressum* (F.)) are the only major pests of cacao in Trinidad [*cf. R.A.E.*, A **35** 88–89], but many other insects are associated with the crop, and some that are normally controlled by natural agents are of potential economic importance. These papers are the first two parts of a series on these minor pests. The first deals with Coccids, and contains descriptions and information on the bionomics, abundance and natural enemies of ten species, some of which has already been noticed [*R.A.E.*, A **42** 44, 377]. Five of them have been found to transmit the virus that attacks cacao in Trinidad [*cf.* **38** 309]; these are *Planococcus citri* (Risso), *Dysmicoccus brevipes* (Ckll.) and a species closely related to it, *Pseudococcus comstocki* (Kuw.) and *Ferrisiana virgata* (Ckll.). *Planococcus citri*, which is the main vector, is dealt with at greater length than the others, and descriptions and notes on the habits of the nine species of ants recorded by P. B. Cornwell as tending Homoptera in Trinidad are included. *D. brevipes* is preyed upon by *Hyperaspis jucunda* (Muls.), *Baccha stenogaster* Will. and a Drosophilid, *Pseudiastata vorax* Sabrosky, which is itself parasitised by *Thysanus* sp. The species of *Dysmicoccus* near *brevipes* has been found only on cacao, on which it forms large colonies on the unripe pods, though it is not common. It transmits the virus as readily as

does *Planococcus citri*, but spreads very slowly and must therefore be unimportant as a vector. Its chief control agent is the Encyrtid, *Neodiscodes kirkpatricki* Kerrich [**42** 44], which sometimes becomes abundant in large colonies, but is itself heavily parasitised.

The second part contains descriptions of the larvae and, in most cases, the pupae, of upwards of 40 species of Lepidoptera that feed on cacao in Trinidad, with very brief notes on their bionomics, abundance and natural enemies. Most are casual feeders on cacao, and the great majority attack the leaves. Some have not previously been recorded from the island.

Fennah (R. G.). **Studies on Cacao Beetle** (*Steirastoma breve* **Sulz. Lamiidae**).—*Rep. Cacao Res. Trinidad 1953* pp. 73–79, 4 graphs, 5 refs. St. Augustine, Trinidad, 1954.

In the first part of this paper, an account is given of observations on the effect of manurial treatment and intensity of light on the infestation of cacao by *Steirastoma breve* (Sulz.) (*depressum* (F.)) in Trinidad, and the following is largely the author's summary of the results. The numbers of trees bearing larval tunnels found in three cacao clones grown under varying light intensities showed a highly significant increase with increasing light intensity. Under the prevailing degree of larval infestation, no significant differences were established between the clones used or between the manurial treatments given. The number of larval tunnels was significantly higher in creviced or cut bark than in smooth level bark, but branches too small to accomodate the larvae appear to be avoided by ovipositing females. Earlier investigators have shown that the adults prefer exposed trees to shaded ones, and it is assumed that the higher prevalence of larval tunnels in unshaded cacao is due to preferential oviposition on unshaded trees and possibly enhanced larval survival. It is concluded that the population increases most rapidly under conditions directly associated with increased insolation.

The adults of *S. breve* feed on the epidermis and chlorophyllous tissues of the young, but already hardened, branches, and the larvae feed on the vascular and parenchymatous tissue and also ingest cambial and, sometimes, woody tissue [*cf. R.A.E.*, A **35** 89]. One of the effects of increased insolation of the tree is an increased carbohydrate content. The ability of the adults and larvae to digest carbohydrates was accordingly investigated and the results are given in the second part of the paper, of which the following is substantially the author's summary. The pH concentration of the fore part of the alimentary canal of both stages varied from 5·5 to 6·8, and its acidity is assumed to be due largely to organic acids produced by micro-organisms. The results of tests of the action of extracts from the digestive tracts of larvae and adults on various carbohydrate substrates indicated the presence of β-fructosidase (sucrase), α-glucosidase, β-glucosidase, β-galactosidase and amylase in the former and of β-fructosidase and amylase in the latter. Cellulase, cytase and α-galactosidase were absent, and no mechanism for the breaking down of lignified tissue was detected. There was no positive evidence that amylase is active in the digestive fluid. Both amylase and sucrase were found to function optimally at the pH usually found in the gut. Amylase activity was depressed by about 25 per cent. in the presence of metals at concentrations near the maximum that can be tolerated by cacao trees. The inability of *S. breve* to digest insoluble carbohydrates and the general low level of soluble carbohydrate reserves in the cacao tree indicate that it is to the advantage of the Lamiid to feed on trees in which carbohydrate is most abundant or carbohydrate metabolism most rapid. This provides a possible explanation for the greater prevalence of the beetle in unshaded cacao.

Fosen (E. H.), Cressman (A. W.) & Armitage (H. M.). **The Hall Scale Eradication Project.**—*Circ. U.S. Dep. Agric.* no. 920, 16 pp., 9 figs., 13 refs. Washington, D.C., 1953.

The following is substantially the authors' summary. *Nilotaspis halli* (Green) was first discovered in the United States at Chico, California, in 1934 [*cf. R.A.E.*, A **23** 700; **24** 458], and was later found in two localities within 100 miles of that city. Since an attempt to eradicate the scale after its first discovery was unsuccessful, a more comprehensive eradication project was organised in 1941 [*cf.* **30** 307]. The preferred food-plants in California are stone fruits, and *Spiraea veitchii* is also attacked. The scales infest all parts of the plants and cause conspicuous blotches on some fruits. The first crawlers emerge in late March or early April, but emergence continues until about mid-October, with at least a partial second generation in the summer. Only females are found during the winter.

The infested properties contained in all about 29,000 food-plants. Infestations in the different areas were probably established by movements of infested plant material. Spread within the areas appears to have been by wind and other agencies, such as birds and insects.

Oil sprays reduced the scale population but did not eradicate it. A method of fumigation with hydrogen cyanide in gastight tents over the plants was developed. Trees were fumigated with 40 cc. liquid HCN per 100 cu. ft. for 50 minutes in the daytime in the dormant season [*cf.* **36** 185]. The gas was introduced with a blower applicator, and most of it was evacuated with a large blower before the tents were removed. Tents made of plastic-covered cloth were transferred from tree to tree with specially designed pullers. The treatment programme consisted of three annual fumigations after the last living scale had been seen, supplemented by spring and summer oil sprays. By the spring of 1952, this programme had been completed on properties containing about 22,000 food-plants. Living scales were found in only two orchards after the first fumigation, and none after the second. After the completion of the programme, previously infested properties were repeatedly inspected.

Hill (C. C.). **Parasites of the Hessian Fly in the North Central States.**—*Circ. U.S. Dep. Agric.* no. 923, 15 pp., 5 refs. Washington, D.C., 1953.

The following is substantially the author's summary. The spring generation of *Mayetiola* (*Phytophaga*) *destructor* (Say) on wheat in the north-central United States is known to be parasitised by 16 species of Hymenoptera, a list of which is given. The percentage parasitism, as determined by examinations of host puparia in 1937–50, averaged 74·8 in Indiana and Ohio over 13 years, and 57·5–82·9 in southern Michigan, Illinois, Missouri, eastern Kansas, south-eastern Nebraska and north-eastern Oklahoma over shorter periods. In Indiana, Ohio and Michigan, *Eupelmus allynii* (French) and *Platygaster zosine* Wlk. were the most important parasites, followed by *Merisus destructor* (Say) and *Pediobius* (*Pleurotropis*) *metallicus* (Nees). Parasitism by *Platygaster zosine* was highest in Michigan. In Illinois, the most valuable parasites in order of importance were *E. allynii*, *M. destructor* and *P. zosine*. The average percentage parasitism of the spring generation in that State was 69·8 in 1919 and 66·8 in 1937–43, indicating that the general equilibrium between the host and its parasites had probably changed little. In Missouri, Arkansas, Kansas, Nebraska and Oklahoma, *E. allynii* ranked first in importance and *Merisus destructor* second. Among the less important parasites in these States, *Eupteromalus subapterus* (Ril.) (*fulvipes* (Forbes)) and *P. herrickii* Pack. were both widely distributed. *P. zosine*

was plentiful in Iowa and present in small numbers in Missouri, though it was not taken in other States west of the Mississippi.

Puparia of the autumn generation of *Mayetiola* were parasitised principally by *P. hiemalis* Forbes over most of the areas studied. Chalcidoids occasionally attacked puparia of the autumn generation in self-sown wheat early in the autumn and also early in spring, just before the adults emerged. The degree of parasitism by *P. hiemalis* fluctuated considerably. In Indiana, the percentage parasitism over four years ranged from 2 to 47·3; in Missouri, there was no parasitism in two out of seven years and the maximum percentage observed was 8·5; there was no parasitism in Kansas in one year out of seven, though it reached 18 per cent. in 1943; and the percentage parasitism was 0·4 and 1·5 in successive years in south-eastern Nebraska, while observations in north-eastern Oklahoma in 1942 showed no parasitism of the autumn generation.

Parker (J. R.), Newton (R. C.) & Shotwell (R. L.). **Observations on Mass Flights and other Activities of the Migratory Grasshopper.**— *Tech. Bull. U.S. Dep. Agric.* no. 1109, [1 +] 46 pp., 6 maps, 12 refs. Washington, D.C., 1955.

The following is substantially the authors' summary. The most spectacular long-distance flights of grasshoppers in the United States and Canada for over 50 years occurred during the summers of 1938–40, the grasshopper concerned being *Melanoplus mexicanus mexicanus* (Sauss.). Flights were preceded by a general increase in numbers throughout south-eastern North Dakota and north-eastern South Dakota, which began in 1935 and resulted in unusually heavy egg laying in 1937. Egg infestations for that year were heaviest and most widespread in north-central South Dakota and adjacent counties in North Dakota. In the spring of 1938, very large numbers of hoppers hatched in the area in which eggs had been most heavily deposited in 1937. Large numbers that attacked crops were destroyed by baits, but still larger numbers in range and fallow land became adult, and these were the main source of migrants.

Mass flights out of the zone of origin began in late June and continued, on days favourable for flying, until 15th August. Swarms travelled in the same direction as the prevailing winds, which were mainly to the north-west and north at times when temperatures were highest and flights most likely to occur. Swarms moving across south-western North Dakota continued into eastern Montana, and some of them eventually reached the South Saskatchewan River in Canada, about 575 air miles from their starting point. Other swarms invaded north-western North Dakota, south-western Manitoba, and south-eastern Saskatchewan. Swarms flying north and north-east settled in north-eastern North Dakota, north-western Minnesota, and south-central Manitoba. Large swarms, presumably from north-central South Dakota, ended their flights in south-western South Dakota, north-western Nebraska, and eastern Wyoming.

In 1939, mass flights began shortly after the grasshoppers had become adult, in all the areas in which eggs had been laid most heavily in 1938. Swarms from eastern Montana and western North Dakota invaded a large area in north-central Montana, southern Saskatchewan and south-eastern Alberta, some of them travelling about 235 air miles, and others from north-western Minnesota and north-eastern North Dakota flew east and west into neighbouring areas and longer distances north and north-west into southern Manitoba. Swarms from south-western South Dakota, north-western Nebraska and eastern Wyoming travelled south-east, south and south-west into south-western Nebraska and northern Colorado. Mass flights were less

important in 1940 and did not result in egg infestations severe enough to produce major flights in 1941.

Observations on the flights showed that they began between 11 a.m. and 1 p.m. on clear days when the air temperature first approached 80°F., provided that the wind was favourable and the adults had an urge to migrate. Wind was the final stimulus, a gentle, intermittent breeze being the most favourable. Migrants usually took off into the wind and then turned and flew with it. When they were flying with a light wind, their speed was 10–12 miles per hour. A few swarms were seen flying very low and upwind towards green crops. Flights in progress terminated abruptly whenever there was a sudden drop in air temperature to below 80°F. or when clouds obscured the sun. On clear, warm days, swarms drifted slowly to the ground several hours before sunset, even when the air temperature remained above 79°F. until after sunset. Crops were injured in all the areas invaded by swarms, in spite of large-scale control campaigns, and the increased losses caused were estimated at nearly 60 million dollars.

Chamberlin (J. C.), Getzendaner (C. W.), Hessig (H. H.) & Young (V. D.). **Studies of Airplane Spray-deposit Patterns at low Flight Levels.**—*Tech. Bull. U.S. Dep. Agric.* no. 1110, [2+] 45 pp., 29 figs., 5 refs. Washington, D.C., 1955.

The investigations described were carried out as part of a programme of research on the development and improvement of methods of applying insecticides from aircraft against pests of vegetables and similar crops in the United States, and the following is virtually the authors' summary of the work.

Studies on the spray patterns developed by aeroplanes flying at low levels were begun in 1947 and were carried out near Portland, Oregon, and in the Blue Mountain pea-growing areas of eastern Oregon and Washington. Most of the spraying was done with a Stearman biplane equipped with a 300-horsepower engine and a constant-speed propeller. The primary purpose was to ascertain and improve aerial spray-deposit patterns at flight levels up to 25 ft. To achieve this, studies were made of the characteristics of the pattern from an even distribution of nozzles along a full-span underwing boom; the patterns of spray from individual 1-foot segments of underwing and tail booms with respect to the aerodynamic forces that affect them; the effect of spray atomisation on the consistency of deposit rates, especially in the zone affected by the propeller vortex; and the arrangement of nozzles, both with regard to atomisation and spacing, required for optimum pattern and swathe width. A carmine dye was used as a tracer in the sprays. The spray deposits were collected on stainless-steel plates and measured by colorimetric analyses. Ciné photographs were taken during application to show the development of the spray curtain as it was affected by air currents generated by the aeroplane flight. Effective swathe widths were determined by practical field tests on insect control.

With aerial spray applications, aerodynamic forces primarily determine the pattern and swathe width covered. Even though the spray is discharged in equal amounts from evenly spaced nozzles along an underwing boom, these forces greatly influence the resultant deposits from foot to foot both across and along the line of flight. Consequently, some zones of the treated swathe receive an excess of spray, while others receive minimal or even subminimal amounts. Moreover, the spray at low flight levels is spread laterally over a swathe from 20 to 50 ft. wider than the boom, depending upon the height of flight and the fineness of the spray.

Aerial applications are especially subject to drift from surface winds. The

effect of such air movements increases with the height of the flight as well as with the fineness of the spray.

The air currents generated by the aeroplane in flight constitute an expanding wake, which comprises three vortices, one produced by the propeller slipstream and the other two by the wing-tips. These latter currents carry the spray out well beyond the wing-tips. The resultant deposit pattern within the propeller slipstream zone is extremely erratic, areas of high and low deposits varying greatly and unpredictably both across and along the line of flight. A second effect of the propeller vortex is to shift much of the spray from that part of the boom lying from 1 to 3 or 4 ft. right of centre to a deposit zone left of centre. In addition, this spray is deposited more rapidly and forcibly than the spray affected by the wing-tip vortices. Beyond the zone affected by the propeller vortex and out to the margin of the swathe, spray deposits tend to be zoned, but with areas of equal deposit varying in width and oscillating irregularly parallel to the line of flight.

Considerable improvement in mean spray-deposit rates across a treated swathe may be obtained from asymmetrical nozzle arrangements, with a massing of nozzles immediately to the right of centre and corresponding reductions to the left of centre, the use of finer sprays inboard than outboard, and applications made at moderate rather than low flight levels. Nevertheless, aerodynamic forces are such that deposit rates will vary considerably across and along the treated swathe. Applications at low flight levels should be keyed to areas of minimal rather than mean deposit rates. Such applications will necessarily give deposits in excess of requirements over portions of the effective swathe.

Symposium on Tristeza Disease of *Citrus*.—*FAO Plant Prot. Bull.* **4** no. 6 pp. 77–94, no. 7 pp. 97–110. Rome, 1956.

This symposium on the virus disease of *Citrus* known as tristeza or quick-decline consists of five papers, abstracts of which appear below.

Wallace (J. M.). **Tristeza Disease of** *Citrus*, **with special Reference to its Situation in the United States** (pp. 77–87, 6 figs., 45 refs.). The author reviews the history and importance of tristeza disease, which has been recorded in various forms from California [*R.A.E.*, A **39** 307], Argentina and Brazil [**37** 319], South Africa, the Gold Coast [**42** 313], Hawaii, Australia, New Zealand and Israel and apparently also occurs in Java, Ceylon and Fiji, and describes the symptoms caused. These are of two main types, comprising a collapse of sweet orange and other varieties or species of *Citrus* on sour-orange or certain other rootstocks, due to necrosis of the bark in the region of the bud union, which prevents the movement of food to the roots, and a stem-pitting of both seedling and budded trees of many different varieties, which is difficult to distinguish from that caused by other factors, including other viruses. Aphids are vectors of the virus [*cf.* **39** 307, etc.], but a record of transmission to lime by a mealybug [**42** 313] needs confirmation.

The disease appeared in California in 1939 and spread gradually in groves of sweet orange on sour-orange rootstocks, more than 300,000 trees having since been destroyed by it. *Aphis gossypii* Glov. has been shown to transmit the virus in California [**39** 307] and Florida, though its efficiency is not great, and a low percentage of transmission has also been obtained experimentally in the latter State with *A. spiraecola* Patch, though negative results were obtained with this and other Aphids in California. The local evidence indicates that the disease is of oriental origin. Varietal susceptibility to it and methods of diagnosis are discussed. Rootstock trials in progress in California have shown that certain varieties of *Citrus* that do not show

decline symptoms when grown as seedlings or on tolerant rootstocks can suffer injury from the stem-pitting form of the disease, so that the use of combinations of scion and rootstock that avoid the decline symptoms only is not considered a satisfactory solution of the problem.

McClean (A. P. D.). **Tristeza and Stem-pitting Diseases of *Citrus* in South Africa** (pp. 88–94, 5 figs., 8 refs.). Tristeza virus has long been present in South Africa, attempts to use sour orange as a rootstock for sweet oranges, tangerines and grapefruit having repeatedly failed. All the sweet-orange trees are probably infected, but little loss has resulted because of the use of rough lemon as a rootstock and the tolerance of the two main varieties grown, though there is a tendency towards a premature decline after 25–30 years. A mild form of stem-pitting is common. Grapefruit is affected by extensive stem-pitting followed by symptoms closely resembling those of tristeza [*cf.* **42** 313]. Early decline occurs both on rough lemon and sweet-orange stocks, and is therefore thought to be due to the sensitivity of the grapefruit scion itself. Similar symptoms have been observed in citron, Tahiti lime and West Indian lime. Trees of the Natal variety of tangerine on rough lemon decline in 10–12 years, whereas those on their own roots are still productive after 30–40 years. Eureka lemon on rough lemon also tends to decline prematurely, and virus infection in it is general. Experiments have shown that sweet lime, sweet rough lemon and *Poncirus trifoliata*, in addition to sour orange, are unsatisfactory rootstocks because of the infection.

The Australian finding of a qualitative difference in the virus content of different species of *Citrus* has been confirmed in South Africa, and a theory is presented that sweet oranges and mandarins take up the tristeza virus complex as a whole and are tolerant of it, while sour oranges, Eureka lemon and grapefruit ordinarily take up only a part of it, of which they are tolerant. The different reactions of various combinations of scion and rootstock reflect these differing tolerances, though grapefruit appears to have a defence mechanism that protects it from the more harmful components of the virus complex. Possible methods of rehabilitating *Citrus* orchards, including the use of nucellar seedlings, which are of asexual origin and initially free from infection, are reviewed.

Costa (A. S.). **Present Status of the Tristeza Disease of *Citrus* in South America** (pp. 97–105, 3 figs., 41 refs.). The tristeza virus is now present in most commercial *Citrus* groves in Argentina, Brazil and Uruguay with trees budded on tolerant rootstocks [*cf.* **37** 319] and has caused great losses in the first two countries. It is expected to spread to the remaining areas of South America, the vector there, *Toxoptera* (*Aphis*) *citricidus* (Kirk.), being highly efficient and widely distributed. The origin and diagnosis of the disease are discussed. *Citrus* types differ as to the ability of the plant to permit virus increase and the tolerance of their tissues to the presence of the virus, and the visible effects appear most clearly following increase of the virus in non-tolerant tissues. The use of tolerant rootstocks for budded trees is the best method of control, and notes are given on those recommended in Brazil, but this method is of little use for West Indian limes and grapefruit, since the virus increases in the scions.

The virus occurs as a complex of strains. Both mild and severe strains are known in Brazil, a stem-pitting strain occurs in South Africa, and the lime disease in the Gold Coast [**42** 213] is a further strain. The seedling yellows of *Citrus* reported from New South Wales also belongs to the complex; the fact that Aphids failed to transmit it in tests is thought to be due to the small numbers used, since in tests in Brazil in which over 100 viruliferous Aphids were used per plant, budding proved a much more efficient method of transmission. The inoculation of various scion-stock combinations with several mild strains and a severe strain of tristeza virus did not result in any segregation into strains that cause stem-pitting and those that do not.

the differences being rather in the severity of the symptoms. The mild and severe strains did not appear to interfere with each other when introduced simultaneously into the plant by budding.

Mendel (K.). **The Threat of Tristeza Disease in the Mediterranean Basin** (pp. 106–108, 6 refs.). The Mediterranean basin appeared until recently to be the only major *Citrus*-growing area in the world that was free from tristeza disease, though sour orange is used almost exclusively for rootstocks there, but the presence of the virus has now been confirmed in Meyer lemon in Israel, and several varieties of *Citrus* that have been introduced into that country over the last 20 years and do not thrive on sour-orange rootstocks are suspected of being carriers. The disease has not spread from Meyer lemon, however, and the possible reasons for this are discussed. *Toxoptera* (*Aphis*) *citricidus* (Kirk.), which is an efficient vector in South America and South Africa [*cf.* **39** 307, etc.], is not present in the Mediterranean region, and *Aphis gossypii* Glov. and *Toxoptera aurantii* (Boy.), which are widely distributed throughout the area, though the former feeds only rarely on *Citrus*, were found to be inefficient vectors in the United States. It has been suggested that only a mild strain of the virus is present, but the consistent failure of Meyer lemon on sour-orange rootstocks appears to indicate that a severe strain is involved. Precautionary measures are necessary, since a local Aphid might become an efficient vector and the virus might become more readily transmissible by molecular change as a result of transmission from one host to another, and the uprooting and destruction of all Meyer lemon trees has been decreed. Protective measures to be adopted throughout the Mediterranean area are discussed. Cecily grapefruit, which is a recognised carrier of the virus, was introduced into Cyprus, but the trees were uprooted two years ago and no instance of dissemination is known.

Doncaster (J. P.) & Eastop (J. F.). **The Tropical *Citrus* Aphid** (pp. 109–110, 5 refs.). As *Toxoptera* (*Aphis*) *citricidus* (Kirk.), the synonymy of which is reviewed, has frequently been confused with *T. aurantii* (Boy.), many records of the latter referring to the former, characters of the alate and apterous viviparae are given differentiating between the two species, together with notes on the distribution of *T. citricidus*.

Madge (P. E.). **A Field Study on the Biology of the Underground Grass Caterpillar, *Oncopera fasciculata* (Walker) (Lepidoptera: Hepialidae), in South Australia.**—*Aust. J. Zool.* **2** no. 2 pp. 193–204, 3 pls., 2 figs., 6 refs. Melbourne, 1954.

Larvae of *Oncopera fasciculata* (Wlk.), which were first reported as damaging pastures in the south-east of South Australia in 1935 [*cf. R.A.E.*, A **25** 653], caused localised damage there in 1937, 1938 and 1940 and heavy damage over a wide area in the same region and in central and western Victoria during 1948–50. The increase in numbers coincided with an increase in the acreage of improved pasture, an intensive drainage scheme, and unusual weather. As a preparation for a study of the factors responsible for the outbreak, observations on the bionomics of the Hepialid were made in South Australia in 1950–53, when populations were low and no damage occurred.

There is only one generation a year, and the adults, which fly and pair at dusk and shelter in the pasture at other times, are present during September–October. Eggs are laid on the ground under the pasture, and the numbers laid per female in the laboratory ranged up to 1,500. In the field, the egg stage lasted 3–5 weeks according to temperature and humidity. When eggs were kept at constant temperatures of 6·3–25·2°C. [43·34–77·36°F.], none hatched in five months at 6·3°C., mortality was lowest (4·5 per cent.) at

12·8°C. [55·04°F.] and development was most rapid (10·97 days) at 25·2°C. The larvae hatch between late September and November, and most appear in late October or early November. They feed gregariously at first on young grass, decayed organic matter and, possibly, soil and fungi, in silken shelters among soil particles at the surface of the soil, and then construct individual vertical tunnels in the soil, from which they emerge at night to feed under silken shelters that sometimes extended for as much as 8 ins. from the tunnel entrance. The tunnels penetrated to depths of 1–1·5 ins. by December, 3–4 ins. by March, and 5–7 ins. in late June and early July, when the larvae are full-fed; their final length rarely exceeded 4 ins. in heavy rendzina soils, but reached 9 ins. in loose, volcanic soils. The larvae feed from October to July on pasture plants, which they cut at ground level, and the damage becomes visible about May, in the form of denuded areas. Pastures composed of annual grasses and clovers were the most heavily attacked. Newly sown lucerne pastures were severely damaged, but established pastures of this plant or *Phalaris tuberosa* were little affected. *Dactylis glomerata* was killed, but various pasture weeds were not attacked. Prepupae were found in July–August, and pupae in July–September, the prepupal and pupal stages lasting two and 2–3 weeks, respectively, and both being passed in the tunnels.

Browning (T. O.). **Observations on the Ecology of the Australian Field Cricket, *Gryllulus commodus* Walker, in the Field.**—*Aust. J. Zool.* **2** no. 2 pp. 205–222, 2 pls., 6 figs., 12 refs. Melbourne, 1954.

Achcta (*Gryllulus*) *commodus* (Wlk.) became injurious in pastures in South Australia in 1931 or 1932 and caused widespread and increasing damage in 1935, 1943 and 1948. Infestation was confined to the south-east, where grain crops and natural pastures are largely being replaced by sown pastures, and an account is given of observations carried out to determine the extent to which this change in agricultural practice was responsible for the increase.

The Gryllid, which is indigenous, has one generation a year. The eggs hatch in mid-November, the nymphs develop in summer, passing through many instars, and the adults appear in late February and comprise virtually the whole population by the end of March. The females oviposit after the first autumn rains, and most of the adults then die within a month. Although *A. commodus* is widely distributed in South Australia, it occurs in large numbers only on the heavy, black, clay soil of the south-east, on which the vegetation is largely native annual grasses or permanent leys of introduced grasses and leguminous plants. Green grass is the chief food, and this is plentiful in the leys at times when native perennial grasses are almost completely withered. The only natural enemies recorded are insectivorous birds and an undetermined Scelionid, which parasitised an average of 7 per cent. of the eggs collected in four localities in 1949. In the laboratory, the parasite adults emerged at the time that unparasitised eggs in the same sample were hatching; they were not seen in the field.

The young nymphs shelter in the cracks that develop in the clay soil during December–January and there is little evidence of feeding. The older nymphs and the adults congregate under stones and other objects lying on the ground. Damage first appears at the edges of the cracks, but becomes widespread later in the year and large areas may be denuded. There is thought to be a nymphal diapause. Adults occur more frequently on the surface of the ground and are more injurious than the nymphs; during late summer and autumn they are most abundant on the surface during warm, sunny weather, but later in the year they are still more numerous during rain. Eggs are sometimes laid after summer showers and are placed in the crown or by the

main stem of the pasture plants, but after the autumn rains they are deposited in the soil. In the laboratory, many more eggs were laid in damp than in dry sand or damp or dry clay, both of which received about the same number. There is some evidence of large-scale migration, on one occasion over a distance of six miles; movement is usually from the black soil to adjoining sandy areas and must result in the almost complete destruction of the next generation. In the laboratory, eight females laid a mean total of 2,563 eggs at 25·8°C. [78·44°F.], as compared with half as many at 22·2 and 29·5°C. [71·96 and 85·1°F.]. Soon after deposition, the eggs enter diapause, which is short at 10–16°C. [50–60·8°F.]; in 1949, diapause was completed in the field by 29th June, but not by 19th May. Observations made each month during the winter and spring of 1949 showed that little egg development occurred during July and August, owing to the low temperatures, and that almost half of it took place in November. Eggs hatched when kept in extremely wet soil or submerged in water, but lost water rapidly under dry conditions, especially when newly deposited or when development was nearly complete; water is lost most slowly during diapause.

Populations were large in 1949 and in general very low in 1950, but they had increased somewhat by 1952. Low populations in 1950 and in one area in 1952 are attributed to reductions in the number of eggs during the preceding dry springs, and there is some evidence that populations are likely to be large only where rainfall in the previous year was high. The association of outbreaks with heavy soil is thought to be due primarily to its capacity for retaining water and less to the additional food supply provided by the improved pastures associated with it, since much larger areas of such pasture on other soils are not infested.

From a review of agricultural practice in the black-soil areas during the past 40 years, it is concluded that *A. commodus* was favoured first by the elimination of grain crops and the ploughing that they necessitated, which destroyed the eggs, and later by the improvement of the pastures, which provided increased food. Since these conditions are likely to persist, outbreaks are expected to increase in severity and extent, but not in frequency, which is determined by spring rainfall.

Common (I. F. B.). **A Study of the Ecology of the Adult Bogong Moth, *Agrotis infusa* (Boisd.) (Lepidoptera: Noctuidae), with special Reference to its Behaviour during Migration and Aestivation.**—*Aust. J. Zool.* **2** no. 2 pp. 223–263, 4 pls., 14 figs., 53 refs. Melbourne, 1954.

The following is largely the author's summary. Observations were made during the summers of 1950–51, 1951–52 and 1952–53 on the ecology and behaviour of *Euxoa* (*Agrotis*) *infusa* (Boisd.) [*cf. R.A.E.*, A **6** 336; **8** 502; **44** 66], the adults of which occur in large assemblages at altitudes above about 4,000 ft. in the Australian Alps. Adults of the spring generation migrate to the mountains, where they aestivate gregariously at or near the summits in crevices and small caves in rock outcrops, many of which are occupied each year from early November until early April. In late summer and autumn, the moths migrate back to their breeding grounds.

A small proportion of the aestivating moths became intensely active for about an hour after sunset and before sunrise each day, when they flew at random over the outcrops. Activity appeared to be initiated by rapidly changing light intensity and was accompanied by pigment migration in the eyes. Food was not sought when the moths were active, although the feeding response was sometimes elicited if they settled on sugary food. However, moisture from rain or dew was apparently ingested as required. Without exception, aestivating moths caught at light traps had not mated and the

ovaries of the females were immature. Their fat-bodies were well developed, and estimates during summer and autumn showed that the average fat content of the abdomens exceeded 61 per cent. of their dry weight for the males and 51 per cent. for the females. Attack by various predators seemed to be unimportant, but a Mermithid nematode caused some mortality when its larvae emerged from parasitised moths at the end of January and beginning of February. This parasite appeared to be confined to the places in which the moths assemble to aestivate, where the larval nematodes overwinter in the moist débris on the floor.

Larvae were not found near the assemblage points in summer, but, during a survey in the late winter and early spring of 1952, mature larvae were common in pastures over a wide area. They were most abundant on heavy, self-mulching soils to the west, particularly in dense stands of *Medicago* spp., and caused serious damage to crops of linseed in northern New South Wales and in southern Queensland. In southern New South Wales, they were numerous in pastures containing clover and cape-weed (*Cryptostemma calendula*), and less so in pastures of subterranean clover [*Trifolium subterranean*] or clover and oats, and in lucerne fields. They are also recorded attacking wheat and various vegetables in late winter and early spring. In the south, the larvae had reached about the third instar in June and were mostly in the final instar in late August and early September, though half-grown ones were not uncommon in the north in September. Larvae collected in the field pupated at the end of September. Several successive generations were reared in the laboratory at 24°C. [75·2°F.], at which the egg stage lasted 4–5 days and total development about seven weeks. The preoviposition period lasted about a week for females reared at this temperature and then kept at 15·5°C. [59·9°F.] and 24–66 days for those from larvae collected in late August and kept when adult at 15·5–20°C. [68°F.]. Viable eggs were not produced unless sugary food was available. It is concluded that although *E. infusa* is a multivoltine species, there appears to be a facultative diapause in the adults of the spring generation. This, together with migration, enables most of the adults to avoid the breeding grounds during summer, when the pastures are dominated by perennial grasses unpalatable to the larvae. The same individuals return to the breeding grounds in the late summer and autumn, after the dicotyledonous annuals on which the larvae feed have germinated.

Jacks (H.). **Screening Tests with Insecticides for Control of Red Spider-mite (*Tetranychus urticae* Koch) on Beans.**—*N.Z. J. Sci. Tech.* (A) **36** no. 5 pp. 454–459. Wellington, N.Z., 1955.

The results are given of greenhouse tests in New Zealand in which 41 toxicants, mostly proprietary preparations, were compared in sprays against *Tetranychus telarius* (L.) (*urticae* Koch) on beans. The surface of the soil was covered in tests with systemic materials to prevent absorption by the roots, and counts of living mites were made 1–12 days after spraying. Among the contact poisons, those that gave satisfactory control, with their minimum effective percentage concentrations, were EPN-300 (27 per cent. ethyl-p-nitrophenyl thionobenzenephosphonate) (0·019), Isopestox (90 per cent. mipafox [bis(monoisopropylamino) fluorophosphine oxide]) (0·038), Murphy Tepp (40 per cent. tetraethyl pyrophosphate) (0·032), 50 per cent. malathion (0·025), Aramite (15 per cent. 2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite) (0·05–0·025) and parathion (0·005). Effective materials that had both contact and residual action were EPN-300 (0·038), parathion (0·02–0·037), Hanane (50 per cent. dimefox [bis(dimethylamino) fluorophosphine oxide]) (0·05), schradan (0·028), Systox (50 per cent. demeton [diethyl

2-(ethylmercapto)ethyl thiophosphate]) (0·05) and summer oil (0·8). Chlorocide (20 per cent. p-chlorobenzyl p-chlorophenyl sulphide) (0·25) showed a residual effect but no contact action. The use of systemic insecticides on plants other than ornamentals is not as yet recommended.

Clark (P. J.) & Jacks (H.). **Arsenic Residues on Apples.**—*N.Z. J. Sci. Tech.* (B) **36** no. 4 pp. 344–346, 1 ref. Wellington, N.Z., 1955.

Further observations on the arsenic residues present at harvest on apples of several varieties sprayed with lead arsenate were made on fruit from orchards in three localities in New Zealand during 1953–54 [*cf. R.A.E.*, A **43** 346]. The sprays normally contained 1·5 lb. lead arsenate per 100 gals., and they were applied as part of a summer programme involving acaricides and fungicides, either throughout the season or until the end of December. The results confirmed the previous finding that residues from sprays applied before January are unlikely to exceed the legal tolerance of 1·5 parts per million arsenic as arsenic trioxide. The tolerance would be exceeded in 72–89 per cent. of orchards sprayed after December, and would be reached in only 0·2–3·4 per cent. of those in which spraying ceased before January.

Wise (K. A. J.). **Pests of Stored Products in New Zealand. I. Family Phycitidae (Lepidoptera).**—*N.Z. J. Sci. Tech.* (B) **36** no. 5 pp. 523–530, 3 refs. Wellington, N.Z., 1955. **II. Family Ptinidae (Coleoptera).**—*Op. cit.* (B) **37** no. 4 pp. 503–508, 3 refs. 1956.

These two parts of a series comprise lists of the species concerned, showing their synonymy, the principal references to them in the New Zealand literature and records of their occurrence in New Zealand, followed by lists of the stored products infested, with the species responsible, and keys to the adults. *Ephestia kuehniella* Zell. (*sericaria* (Scott)), *E. elutella* (Hb.), *E. cautella* (Wlk.), and *Plodia interpunctella* (Hb.) are dealt with in the first part, and *Mezium affine* Boield., *Niptus hololeucus* (Fald.), *Trigonogenius globulus* Sol., *Ptinus tectus* Boield., *P. hirtellus* Sturm, and *P. fur* (L.) in the second. Of the latter, *M. affine* and *P. hirtellus*, which appears to be firmly estabished, are recorded from New Zealand for the first time. The collection of the British Museum contains specimens of *P. fur* from New Zealand, but all specimens labelled *P. fur* in New Zealand collections are referable to *P. tectus*, and all local records of *P. fur* [*cf. R.A.E.*, A **10** 168; **18** 196] probably refer to this species, which is common, widespread and well established.

Blacklock (J. S.). **A short Study of Pepper Culture with special Reference to Sarawak.**—*Trop. Agriculture (Trin.)* **31** no. 1 pp. 40–56, 3 figs., 21 refs. London, 1954.

This paper on the cultivation of pepper (*Piper nigrum*) in Sarawak contains a short section on insects and other pests that attack the crop. The insects mentioned comprise *Lophobaris serratipes* Mshl., which feeds on the berries, often causing premature shedding and considerable crop loss, *Elasmognathus hewitti* Dist. and *Dasynus piperis* China [*cf. R.A.E.*, A **22** 59], which suck the young berries, causing discoloration and premature shedding, *Pelargoderus bipunctatus* (Dalm.), the larvae of which attack the stems and shoots, usually on unhealthy vines, *Helopeltis antonii* Sign., which occasionally causes die-back of shoots and buds and deformation of leaves, *Gynaikothrips charicae* Zimmermann and *G. crassipes* Karny, which sometimes produce

galls on the leaves during the dry season but are not of great importance, *Pagodiella* (*Eumeta*) *hekmeyeri* (Heyl.), larvae of which also cause some damage to the leaves, and *Coptotermes curvignathus* Hlmgr., which occasionally attacks the roots of diseased vines.

Puttarudriah (M.) & Channabasavanna (G. P.). **Some new Insect and Mite Pests of Areca Palm in Mysore.**—*Mon. Bull. Indian Arecanut Comm.* **4** no. 5 pp. 71–74, 8 figs., 4 refs. Calicut [?1953].

Dysmicoccus brevipes (Ckll.), *Cerataphis lataniae* (Boisd.) and *Raoiella indica* Hirst are recorded for the first time attacking areca palm [*Arcca catechu*] in Mysore. *D. brevipes* in all stages was observed in large numbers round the stems of seedling palms where these issue from the seed, sometimes killing them. Infestation escapes notice in its early stages as this part of the plant is normally covered by the soil and the mealybugs are also partly hidden among the fibrous matter surrounding the seed, and it is suggested that the base of the seedings be dipped in a contact insecticide at the time of transplanting. *C. lataniae* infested the inflorescences and later the nuts, preventing the latter from developing or causing them to fall, and a sooty mould developed on the honeydew. *R. indica* caused considerable damage in one area, particularly in the summer. The mites were found in large colonies beneath silken webs on the lower surfaces of the leaves, which withered and dried up when infestation was heavy, but the populations decreased greatly after the onset of the south-west monsoon in June–July.

Nirula (K. K.). **Investigations on the Pests of Coconut Palm. Part I.**—*Indian Cocon. J.* **8** no. 3 pp. 118–130, 43 refs. Ernakulam, 1955.

The author reviews the world distribution of coconut, gives a list of over 100 insects and one mite that are known to attack the palms in various countries, showing their distribution and the nature of the damage caused, and states that the most important on the west coast of India are *Oryctes rhinoceros* (L.) [*cf. R.A.E.*, A **43** 229] *Nephantis serinopa* Meyr. [*cf.* **43** 231], *Rhynchophorus ferrugineus* (Ol.), and *Leucopholis coneophora* Burm. [*cf.* **43** 295]. Notes on the damage caused by over 20 pests of minor importance in India are appended.

De (R. K.) & Dutta (D. K.). **Effect of commercial Octamethylpyrophosphoramide (Schradan), a systemic Insecticide, on the Mango Hopper, *Idiocerus atkinsoni* Lethierry (Homoptera: Jassidae).**—*Indian J. Hort.* **12** no. 4 pp. 165–172, 2 figs., 12 refs. Sabour, 1955.

Laboratory tests on the control of *Idiocerus atkinsoni* Leth., an important pest of mango in India [*cf. R.A.E.*, A **44** 216, etc.], were carried out with Pestox 3, which contains schradan and its higher homologue, triphosphoric acid penta(dimethylamide) [*cf.* **40** 147], at temperatures of 96–105°F. and an average relative humidity of 51 per cent. In the first, in which adults were caged with freshly cut mango twigs that had been sprayed with various dilutions of Pestox, examination after 2–28 hours showed that a concentration of 0·2 per cent. was ineffective, but that 0·3, 0·4 and 0·5 per cent. gave about 10–20 per cent. mortality in four hours and complete kill in 24–28 hours. In a similar test at concentrations of 0·3–0·5 per cent., in which the twigs were sprayed with insecticide and then with water before the insects were put on 30 minutes later, nearly 10–20 per cent. mortality was

obtained in six hours and 87–96 per cent. in 28 hours, indicating that control could be obtained during periods of occasional rain, though it would be delayed. When adults were caged on young mango plants that had been sprayed, examination at intervals of two hours showed that 41, 42, 54 and 54 of 120 insects died within ten hours and 17, 33, 38 and 40 in 10–20 hours after no treatment and treatment with 0·3, 0·4 and 0·5 per cent. Pestox, respectively, and that all sprays caused complete mortality in 34 hours, when that on untreated plants was 76·66 per cent. The most effective concentration is considered to be 0·4 per cent.

Basheer (M.), Krishnamurthy (C.) & Nagarajan (K. R.). **Studies on the Control of the Early Shoot Borer of Sugarcane, *Chilotraea infuscatellus* Snell. by chemical and cultural Methods in the Madras State.**— *Indian J. Ent.* **16** (1954) pt. 4 pp. 350–361, 5 refs. New Delhi, 1955.

Chilotraea infuscatella (Sn.) is a serious pest of sugar-cane throughout Madras, being active from April–May until July–August; the larvae bore into the central shoots of young plants and their tillers, thus killing them, or into the internodes of well formed canes, but infestation abates as the crop grows and later becomes almost insignificant. The egg, larval and pupal stages and the complete life-cycle last about 3–4, 35, 6–10 and 45 days, respectively.

Experiments on control with DDT or BHC applied against the very young larvae or by cultural methods were carried out in 1946–50. In 1946, one or two applications of dusts of 2·5 or 5 per cent. DDT or BHC reduced egg populations and borer incidence and (with one exception) increased the yield, but the differences were not significant. In 1947–50, sprays containing 0·25 per cent. 50 per cent. wettable DDT or BHC with casein as the adhesive were applied four times at monthly intervals from about 45 days after planting, when the first deadhearts usually appear. Counts made as soon as deadhearts were noticed and at intervals of 21 days until a month after the last spray application showed significant reductions in infestation by both insecticides in all three years, DDT consistently resulting in the smallest number of deadhearts. Preliminary examination of canes at harvest showed an increase in the proportion of uninfested ones in sprayed plots, with little difference between treatments. Infestation by *Proceras indicus* Kapur was generally low in treated plots. Yields were higher in treated than in untreated plots in the year 1949–50 but lower in 1947–48 and 1948–49.

In 1946–47, earthing up the young plants to three quarters of their height to prevent the recently hatched larvae of *C. infuscatella* from reaching the base of the shoots was tested on various dates. Counts of egg populations and borer incidence just before earthing up and of deadhearts after it showed no better results from treatment 40 or 80 days after planting or both than from treatment 120 days after planting. In further tests in 1947–50, the plants were earthed up one, two and three months after planting, and the first two treatments appeared to give satisfactory control in 1948–49 and 1949–50, whereas the third had no apparent effect in any of the three years. Yields in earthed plots were higher in 1947–48 and lower in the other years than for no treatment, and the juice showed a slightly better analysis in the first two seasons but not in the last.

Many pests hibernate, hide or breed in cane stubble, and it was shown that the juice extracted from the underground parts of the canes would compensate for the extra cost of digging out the stubble, but the method may not be practicable in all places as the quality of the juice is generally poor and possibly unacceptable to the sugar factories, digging out the stubble

may be feasible only in loamy soils, and labour may not be available for digging at harvest time.

Raja Rau (S. A.). **Bionomics and Life-history of *Aphidius* sp.—a Parasite on *Aphis gossypii* Glov. on Brinjal** (*Solanum melongena*).—*Indian J. Ent.* **16** (1954) pt. 4 pp. 362–371, 9 figs., 7 refs. New Delhi, 1955.

Severe infestation of brinjal (*Solanum melongena*) by *Aphis gossypii* Glov. was observed in several localities in Bombay in July–September 1950, many young plants being killed by the attack. Parasitism by an unidentified species of *Aphidius* was high, this Braconid being apparently favoured by the climate conditions of these months, when the average temperatures were 68–76·3, 68·9–79·9 and 68·7–79·6°F. and the average humidities 90·4, 93 and 92·3 per cent., respectively. Observations on the parasite, all stages of which are briefly described, showed that the females lived longest in December and the males in July and October, and that the two occurred in approximately equal numbers. Pairing began about 6–8 hours after emergence, eggs were laid throughout the day but not at night, and each female oviposited in a number of Aphids if they were available or repeatedly in the same one if they were scarce; they attacked second-instar nymphs in the absence of adults, though this resulted in the death of both the host and the parasite progeny. Well developed Aphids continued to reproduce for 24 hours after being parasitised, producing averages of 4·4, 2·8 and 2·5 nymphs in that period in July, August and September, respectively.

Observations on leaves selected at random every month from July 1950 to June 1951 showed that parasitism reached its maximum in July and its minimum in May. In July, August and September, single females attacked 15–66, 26–72 and 18–42 Aphids each in three days, and the percentage parasitism was 42·5–91·5, 40·3–78·5 and 18·2–72·5, respectively. The egg and pupal stages and complete development lasted 3–4, 5–6 and 13–14 days, respectively. Although the parasite attacks fairly large numbers of *Aphis gossypii*, it is of limited economic importance as its rate of reproduction is much lower and it does not become numerous until the Aphid infestation is well advanced. The Aphids are also attacked by *Coccinella* (*Harmonia*) *arcuata* ab. *cingulata* F., which destroys any parasites in them.

Tirumalarao (V.) & Nagarajarao (K. R.). **A Note on the Control of *Lasioderma serricorne* Fab.—a Pest of stored dry Ginger.**—*Indian J. Ent.* **16** (1954) pt. 4 pp. 416–418, 3 refs. New Delhi, 1955.

Lasioderma serricorne (F.) has recently caused serious damage to stored dry ginger in southern India, the rhizomes being exposed to infestation from the time of gathering, and investigations on its control were carried out from September 1952 to August 1953. These showed that exposure to 2 lb. methyl bromide, 20 lb. of a mixture of ethylene dichloride and carbon tetrachloride or the hydrogen cyanide from 4 lb. Cyanogas calcium-cyanide dust per 1,000 cu. ft. for 24, 48 and 24 hours, respectively, eliminated the initial insect population, and that subsequent external applications of 2 oz. of a dust containing 0·65 per cent. lindane [almost pure γ BHC] per 100 sq. ft. of bag surface, once a month, prevented reinfestation. There is a risk to health in using methyl bromide, and although dry ginger has been shown to absorb no HCN during fumigation, the ethylene-dichloride mixture is considered the best fumigant for use by untrained workers.

Patel (N. G.), Patel (G. A.) & Kulkarni (Y. S.). **Insecticidal Control of Spotted Boll Worm (*Earias* spp.) of Cotton.**—*Indian J. Ent.* **16** (1954) pt. 4 pp. 422–423. New Delhi, 1955.

Species of *Earias* attacking cotton were controlled in the State of Bombay by the complete uprooting of stems soon after harvest, until improvements in irrigation led to the growing of *Hibiscus esculentus*, an important alternative food-plant, as a summer crop. In tests of organic insecticides in 1953–54 for the control of the serious infestations that then developed on cotton, a spray of 0·2 per cent. DDT, applied eight times at weekly intervals, gave no control and one of 0·2 per cent. toxaphene reduced infestation from 62·9 to 58·5 per cent., but did not affect the average yield. In 1954–55, on small plots of cotton, seven applications at weekly intervals of 0·05 per cent. endrin, 0·4 per cent. toxaphene and a mixture of this and 0·2 per cent. DDT, all at 130 gals. per acre, reduced the average infestation from 60·3 to 33·3, 41·3 and 40·3 per cent., respectively, and resulted in substantial yield increases.

Chatterji (S.). **Effect of some inert Dusts on *Trogoderma granaria* Everts.**—*Indian J. Ent.* **16** (1954) pt. 4 pp. 423–425. 8 refs. New Delhi, 1955.

In a laboratory test of several inert dusts for the control of *Trogoderma granarium* Everts at New Delhi in June and July 1954, cleaned wheat (10·48 per cent. moisture content) was mixed with mica, felspar, kaolin, calcite, dolomite, limonite or magnesite, containing 37, 39·3, 43·6, 69·5, 68·7, 58·2 and 75 per cent. of particles less than 0·076 mm. in diameter, respectively, at the rate of 100:1 by weight. It was then infested with first-instar larvae and left for 45 days, during which the minimum and maximum temperatures were 78–92·5 and 81–103·5°F. and the relative humidity 26–90 per cent. Statistical analysis showed that the last four materials significantly reduced the loss of weight and proportion of damaged grains, whereas the first three did not. Effectiveness tended to vary with the fineness of the particles.

Steel (W. O.) & Howe (R. W.). **A new Species of *Cryptolestes* (Coleoptera: Cucujidae) associated with stored Products in Africa.**—*Proc. R. ent. Soc. Lond.* (B) **24** pt. 5–6 pp. 107–109, 2 figs. London, 1955.

The authors consider that the genus *Laemophloeus* should be split into a number of distinct genera, some hitherto regarded as subgenera or synonyms and some not yet described. The genera concerned are to be discussed fully at a later date. Of the species recorded from stored products, *L. spartii* (Curt.) (*ater* (Ol.)), *L. minutus* (Ol.), *L. turcicus* Grouv., *L. ferrugineus* (Steph.) and *L. pusilloides* Steel & Howe [*R.A.E.*, A **40** 362] are transferred to the genus *Cryptolestes*, and *L. janeti* Grouv., which is apparently predacious on other pests, to *Leptophloeus*. *C. ugandae*, sp. n., is described from adults of both sexes reared in the laboratory in England from parents collected in Uganda, where the species was found in 1952 in maize cobs, mtama millet [sorghum], groundnuts and cassava [*Manihot utilissima*]. Single examples are recorded from millet in the Gold Coast and cowpeas in Nigeria, and one was taken on a ship at Liverpool in cowpeas from East Africa. Characters distinguishing it from *C. minutus*, *C. turcicus* and *C. pusilloides* are given.

Salmond (K. F.). **Fumigation of Maize with Methyl Bromide.**—*Nyasaland Fmr For.* **1** no. 4 pp. 39–44. Zomba, 1954.

In 1953, stacked bags of up to 1,000 short tons of maize in Nyasaland were fumigated with methyl bromide under polyvinyl-chloride sheeting at a dosage of 2 lb. per 1,000 cu. ft. for 24 hours for the control of insect infestation. Small samples of the grain were examined three months later, and the numbers of insects present, almost without exception *Calandra oryzae* (L.), were found to average 1·6–5·3 and 26·3–32 in treated and untreated samples, respectively. All the insects in the fumigated maize were dead, and almost all those in the unfumigated maize were living. An average of 2·17–2·78 per cent. of the grains in the treated samples were damaged, as compared with 4·83–7·25 per cent. for no treatment.

Salmond (K. F.). **Arthropods associated with stored Groundnuts in Nyasaland.**—*E. Afr. agric. J.* **21** no. 3 pp. 148–151, 1 fig., 8 refs. Nairobi, 1956.

A survey was made in February–March 1955 of the insects and mites associated with groundnuts stored in the pod under village conditions in the Central Province of Nyasaland. The groundnuts were from the 1954 crop, and the containers of the usual mudded bamboo type standing on platforms. Infestation was found to be generally moderate, but sufficient to maintain foci capable of infesting the new crop when stored. It was confined entirely to damaged pods. Of the Lepidoptera found, *Ephestia cautella* (Wlk.) was the only one of importance, the larvae feeding on the kernels and pupating within the pods. The Coleoptera included *Tribolium castaneum* (Hbst.), which was the most important, all stages occurring in damaged pods, *Gnathocerus cornutus* (F.), *Oryzaephilus mercator* (Fauv.), *Ahasverus advena* (Waltl), which infested groundnuts showing a high degree of rancidity and mouldiness, and a species of *Trogoderma*, possibly *T. granarium* Everts, two larvae of which were taken and which has not previously been observed by the author in any locally-stored produce in Nyasaland, though it is a pest of groundnuts in other parts of Africa. Termites cause superficial damage to the pods after ripening but before harvest, and a list is given of eight species collected on the growing crop; no termites were found on the stored groundnuts inspected, and the injury is not sufficient to afford entry to stored-product pests. The percentages of pods that were sound, damaged by termites and broken (many of these last being infested by insects) were 60·32–78·94, 13·89–32·37 and 7·17–12·76, respectively. The degree of infestation by *Tribolium* and *Ephestia* appeared to be largely dependent on the numbers of damaged pods brought into store, since, like all the other pests found, they are unable to penetrate sound pods. Most of the broken ones were damaged at the stalk end, and it is recommended that more care be taken when the pods are detached from the plants.

Mallamaire (A.). **Les insectes nuisibles aux produits végétaux et denrées alimentaires entreposés à Dakar.**—*Bull. Prot. Vég. A.O.F.* no. 1 pp. 48–57, 17 figs. [Dakar] 1954.

A table is given showing the principal insect pests of stored products observed at Dakar in 1952, and the products attacked by them, together with notes on some of the more important. Groundnuts were attacked both in the field and when stored in heaps after harvest by the Lygaeids, *Aphanus sordidus*

(F.), *A. apicalis* (Dall.), *Dieuches patruelis* (Stål), and *D. armipes* (F.), the nymphs and adults piercing the pods and feeding on the seeds. Stored groundnuts were also attacked by the Bruchid, *Pachymerus cassiae* (Gylh.), and decorticated ones by *Tribolium confusum* Duv., *T. castaneum* (Hbst.), *Corcyra cephalonica* (Stnt.) and *Ephestia cautella* (Wlk.). Other pests of decorticated groundnuts and groundnut cake were *Lepisma saccharina* L., *Thermobia domestica* (Pack.), *Embia vayssierei* Navás, *Lasioderma serricorne* (F.), *Laemophloeus* sp., *Oryzaephilus mercator* (Fauv.), *Attagenus* sp., *Carpophilus dimidiatus* (F.), *Homala polita* Solier and *Tenebroides mauritanicus* (L.). Imported wheat flour was infested by *Calandra granaria* (L.), *C. oryzae* (L.), *Pyralis farinalis* (L.) and *E. cautella*, and various cereal products by *C. oryzae*, *Trogoderma granarium* Everts, *Stegobium* (*Sitodrepa*) *paniceum* (L.) and *Gnathocerus cornutus* (F.). Maize and sorghum were attacked by *C. oryzae*, and imported rice from Viet Nam and Siam was severely infested by the same species and by *Tribolium castaneum*, *T. confusum*, *Tenebroides mauritanicus*, *O. surinamensis* (L.) and *Corcyra cephalonica*. Cacao beans and coffee were sometimes attacked by *Araecerus fasciculatus* (Deg.). Haricot beans were attacked by *Bruchus obtectus* Say (*Acanthoscelides obsoletus*, auct.), cowpeas by *B.* (*Callosobruchus*) *chinensis* L. and *B. maculatus* F. (*C. quadrimaculatus* (F.)), dried fish by *Dermestes* spp., and tobacco by *Lasioderma serricorne*.

RÉAL (P.). **Le cycle annuel du puceron de l'arachide** (*Aphis leguminosae* **Theob.) en Afrique noire française et son déterminisme.**—*Rev. Path. vég.* **34** fasc. 1–2 pp. 3–122, 58 figs., 5 pp. refs. Paris, 1955. (With a Summary in English.)

A detailed account is given of investigations in French West Africa on the bionomics and ecology of *Aphis craccivora* Koch (*leguminosae* Theo.), a pest of groundnuts, to which it transmits the virus of rosette disease. No sexual forms are present, and in the first part of the paper, the author records numerous laboratory investigations on the development and fecundity of the Aphid. Several strains were reared, up to 40 successive generations being studied, and differences in development are noted. The observations were chiefly concerned with those females in each generation (termed eugonic) that completed their development in the shortest time and produced the most offspring. Among these, the mean minimum time between generations was almost 6·5 days and the average was a little over 8·3 days, the reproductive period averaged 6·7 days, and an average of nearly 2·1 offspring was produced daily, each individual producing an average total of about 14. The individual maxima observed were 70 offspring from one female and a reproductive period lasting 43 days in another. The four nymphal instars averaged about 2, 1·5, 1 and 1 day, respectively, and reproduction began after a further 2·76 days, but when both temperature and humidity were high, some individuals reproduced in the second or third nymphal instar. Mortality before reproduction began averaged about 60 per cent. Eugonic females were produced early in the reproductive period of their parents, at the rate of about one per individual female. Individuals produced before and after them (termed anagonic and catagonic, respectively) showed less favourable characteristics, and lines derived from them died out in many cases. The whole population increased 3–5 times per generation, and the evolution of Aphid populations under natural conditions is discussed in the light of the observations made.

The second part is largely concerned with the effect of environmental conditions on development and the appearance of winged forms. The effects of temperature and relative humidity on the duration of nymphal development, the reproductive cycle, the period of reproduction, total and daily

fecundity and length of life are shown on graphs by means of zones of equal response, and it is held that the optimum zones can be characterised within limits by a quantity termed the hygrothermic degree, for which an expression is derived involving the temperature and water content of the air. Various tests are described from which it is concluded that exposure to direct sunlight is detrimental to fecundity, but that this is outweighed by its stimulating effect on photosynthesis in the plant, on which the Aphids depend for food. The production of alates is considered to be stimulated principally by the translocation of depolymerised carbohydrates that normally accompanies photosynthesis and varies in intensity with season and plant maturity, and various factors, both natural and artificial, concerned with the physiology of the plant that prevent or increase translocation, and thus influence the production of alates, are discussed. One such factor is the rosette disease itself, which accelerates the development of the groundnut plant and thus results in the production of more alates. In a discussion of the features of Aphid physiology that tend to the production of alates, it is pointed out that dense Aphid colonies produce artificial translocation of depolymerised substances as a result of the injection of enzymes, even after feeding has ceased.

The third part comprises a discussion of the effects of some of these factors on the occurrence and distribution of the Aphid in the field. Close planting of groundnuts is known to reduce infection with rosette disease [*cf. R.A.E.*, A **32** 258, etc.], and densely planted strips round a field have been shown to arrest the spread of the Aphid to the plants in it. The main reason for this was found to lie in the reduced exposure to the sun of the crowded plants, which reduced photosynthesis and consequently fecundity and the production of alates. Infestation occurs during the wet season, and it was found that the spread of the disease did not begin until about 35 days after the first ten-day period in which the minimum daily relative humidity was above 70 per cent. and ceased 10–30 days after humidity had again fallen below this limit. Maps of West Africa are given, showing the zones in which climatic conditions favour severe or periodic outbreaks of *A. craccivora* and those where outbreaks do not normally occur; the limits of the zones, which can be determined by relative humidity, are discussed. Infestation is generally more severe in the coastal belt, up to 125–250 miles inland, than in the interior. The bionomics of *A. craccivora* in the Soviet Union, where the Aphid is found on cotton and sexual forms occur [*cf.* **27** 215], are reviewed, and its distribution and food-plants in other parts of the world are discussed. The author considers that the Aphid on groundnuts in French West Africa is a race that has lost the ability to produce sexual forms in the process of its adaptation to new climatic conditions and a new food-plant.

Vrydagh (J. M.) & Cooreman (J.). **L'araignée rouge du coton au Congo belge.**—*Bull. agric. Congo belge* **44** no. 6 pp. 1325–1334, 1 col. pl., 2 figs., 3 refs. Brussels, 1953. (With a Summary in Flemish.)

Tetranychus telarius (L.) was found in the Belgian Congo, apparently for the first time, in 1953, when it was observed infesting cotton in the Ruzizi valley in Kivu. No males were seen. The distribution, bionomics, food-plants and natural enemies of the mite are reviewed, and all stages are briefly described. In experiments, dusting with 10 per cent. DDT practically eliminated the mites from treated fields in spite of heavy rainfall, but as it is known that such treatment may ultimately result in an increase in the population, owing to the destruction of natural enemies, a large proportion of sulphur should be added to the dust. Protective measures recommended comprise sowing cotton at a distance from other known food-plants of the mite, burning infested plants as soon as they are found, and destroying all

plants after harvest. The use of mulch in cotton fields prevents the movement of mites over the soil, and 2–3 years should be allowed to elapse before cotton is again grown on land that has borne an infested crop.

FOUCART (G.). **Un nouvel ennemi du caféier d'Arabie au Kivu** *Habrochila placida* **(note préliminaire).**—*Bull. INEAC* **3** no. 1 pp. 51–62, 1 fig. Brussels, 1954.

Coffee in Kivu, in the Belgian Congo, has recently been damaged by *Habrochila placida* Horv. [*cf. R.A.E.*, A **42** 207], probably mainly because of the destruction of the natural enemies of this Tingid by the extensive use of DDT and BHC, and investigations on its bionomics and control were begun in 1952. Observations on coffee at elevations of about 5,410 and 5,740 ft. showed that the egg stage, four nymphal instars and complete life-cycle lasted 13–16, 4–6, 3–6, 3–6, 2–7 and 36–38 days, respectively. Oviposition began 3–7 days after the last moult and continued for 2–3 weeks, females depositing about 100–120 eggs each. Most of the damage is caused by the nymphs, which feed continuously in groups on the lower leaf surfaces, buds and young fruits; the adults feed on the same plant parts, but singly, intermittently and for a shorter total period. Light infestations cause little damage, but severe ones destroy almost all the foliage and retard the growth of new leaves. Injured flower buds turn brown and dry up, but this type of injury is rare. Attacks begin at the end of the dry season and increase to a maximum during the rainy season in January and February. During the dry season, foci of infestation persist only in humid areas near streams. In food-plant tests, the insects soon died when transferred to tea, *Cinchona* and other plants, including weeds and leguminous cover crops and shade trees, and there was considerable variation in the population that developed on different strains and species of coffee, three local strains of *Coffea arabica* showing appreciable resistance.

Pyrethrum, DDT and BHC are ineffective against *H. placida*, but Folidol E 605 (46·6 per cent. parathion) gave complete control in 3–6 hours at concentrations of 0·06–0·1 per cent. by volume and 95 per cent. in three days at 0·04 per cent. Similar results were obtained with Polyxane (20 per cent. parathion) at equivalent parathion concentrations. Sprays should be applied to the lower leaf surfaces and mainly towards the bases of the trees, where infestation is generally heavier than in the crowns. As the parathion sprays tended to favour an increase of other injurious insects, it is suggested that a single application should be made in August–September, at the onset of the rainy season, and a second only if the *Habrochila* nymphs reappear within 20 days. When only part of a plantation is affected, care should be taken not to spread the infestation by the carriage of insects on the clothing. Humid areas should be examined for foci of infestation and these should be sprayed in the dry season so that subsequent general applications become unnecessary.

DÜRR (H. J. R.). **Sekere waarnemings aangaande die seisoensgeskiedenis van die argentynse mier,** *Iridomyrmex humilis* **(Mayr), onder winterreënvaltoestande.** [Investigations on the seasonal History of the Argentine Ant, *I. humilis*, under Conditions of Winter Rainfall.]—*Tydskr. Wet. Kuns* (N.S.) **16** pt. 1 pp. 206–209, 8 refs. Bloemfontein, 1956. (With a Summary in English.)

In investigations at Stellenbosch, South Africa, nests of *Iridomyrmex humilis* (Mayr) were excavated each month from August 1954 to July 1955,

taken to the laboratory and examined. The results showed that the various developmental stages of the workers were present all the year round, but that egg production decreased considerably during the winter. Sexual forms were produced in early summer and also in autumn. This was unexpected and indicates that new colonies can be founded at that season.

Bagnall (B. H.) & Hale (E.). **Experiments with Red Spider Ovicides.**—*Grower* **41** no. 9 pp. 469, 471. London, 1954.

Field tests on apple in Britain in the summer of 1952 showed that the ovicide, p-chlorophenyl benzenesulphonate, applied at 2·5 lb. 20 per cent. wettable powder per 100 gals. water, gave virtually complete control of the fruit-tree red spider [*Metatetranychus ulmi* (Koch)] and resulted in low populations of winter eggs when applied twice at an interval of 21 days, or once with the addition of derris extract or parathion, which are effective against the active stages. Similar applications of diphenyl sulphone gave inferior results and had little effect on the winter-egg population. Since the sulphonate damaged the fruits of some varieties, notably Worcester Pearmain and James Grieve, further tests were carried out in 1953 to determine whether the injury had been associated with the unusual drought conditions of the previous year. In the first series, the sulphonate was applied at 2·5 lb. 20 per cent. wettable powder and at 2 and 4 pints 20 per cent. emulsion concentrate per 100 gals. water. The untreated trees were heavily infested by 30th June, but trees sprayed at the pink-bud stage were almost free from infestation, and similar results were observed on 31st July on trees treated at the pink-bud and petal-fall stages. However, cracking of fruitlets was observed on Worcester Pearmain sprayed at the pink-bud stage with the wettable powder or at both stages with the emulsion concentrate. Similar sprays of 1 lb. 50 per cent. wettable p-chlorophenyl p-chlorobenzenesulphonate per 100 gals. caused no injury. A second series of tests was designed to determine the lowest concentration at which effective control can be obtained with two applications in midsummer. The two sulphonates at ordinary commercial concentrations proved very effective, and when good control was obtained by the end of July, the numbers of winter eggs laid were considerably reduced. Diphenyl sulphone again gave poor results. Recommendations are made for spray programmes including the sulphonates, for the control of the mite on apple and other fruits.

Emery (G. A.). **Trials with systemic Insecticides on Hops.**—*World Crops* **6** no. 7 pp. 289–292, 4 graphs. London, 1954.

Experiments on the control of *Phorodon humuli* (Schr.) on hops by systemic insecticides were carried out in Kent and in western England in 1953. The materials tested in sprays, which were applied at 100 gals. per acre on 3rd–10th June, when the bines were about 6 ft. high, and later at twice the rate, comprised schradan as a commercial 45 per cent. product and as 70 per cent. pure redistilled schradan, of which both contained a wetting agent and were tested at 6 and 12 fl. oz. per 100 gals.; Systox, containing 50 per cent. demeton (diethyl 2-(ethylmercapto)ethyl thiophosphate) and a wetting agent, which was used at 2, 4 and 8 fl. oz. per 100 gals.; and a product containing 80 per cent. pure redistilled tris(dimethylamino) phosphine oxide, which was used at 16 fl. oz. per 100 gals. In addition, a commercial preparation containing dimefox (bis(dimethylamino) fluorophosphine oxide) was tested at 0·5–2·5 per cent., 100 ml. being applied to the soil of each hill.

Observations made 48 hours after the first spray applications showed complete control of adult apterae. Plants treated with the schradan products at the higher concentration remained free from infestation for 30 days, and the relatively small numbers that developed within about the next 20 days were held in check by predacious Coccinellids and Anthocorids, which had not been appreciably affected by spraying. In the plots treated with schradan at the lower concentration, infestation reappeared after 21 days and the subsequent increase was more rapid. Demeton afforded protection for 15 days at 8 and 4 fl. oz. and for ten days at 2 fl. oz., after which there were sharp rises in the Aphid population; very considerable destruction of predators had been observed after spraying with this material. The results given by tris(dimethylamino) phosphine oxide were inconclusive, the control obtained varying with plant variety and being maintained for not more than 15 days. The Aphid was not completely eliminated from plots given the soil treatment until ten days after application, but, except for those treated at the lowest concentration, the plots then remained free from infestation until picking.

After a second spray application, schradan gave complete control in 5–10 and 7–15 days at 12 and 6 fl. oz., respectively, and the hops remained uninfested until picking, except for two varieties that were treated at 6 fl. oz. and required a third application, which gave control in 10–12 days. After a second application of demeton at 8 fl. oz., complete control was obtained in ten days in some plots, but infestation increased in others, necessitating a third application after 12–15 days, which controlled the infestation within a further week. Demeton at the lower concentrations was unsatisfactory. No Aphids migrated to the hops after 17th July and consequently, after the third spray application, the plants remained free from infestation until picking.

Concurrent observations in districts in which *Tetranychus telarius* (L.) was present showed that the plots given the soil treatment were free from the mite. Infestation was low on those sprayed with schradan, moderate on those treated with demeton and high on those treated with tris(dimethylamino) phosphine oxide. When the dimefox product was applied in the third week of July at 0·5, 1, 1·5 and 2·5 per cent. round severely infested hops, the mites were destroyed within 3–5 days and the two higher concentrations kept the hops free from infestation until picking, by which time small numbers were present on plants treated at the lower concentrations.

Analyses of the treated hops after drying revealed no significant insecticide residues, and no effects on the stability or flavour of the beer were observed in tests with hops treated with dimefox.

White (M. G.). **The House Longhorn Beetle *Hylotrupes bajulus* L. (Col. Cerambycidae) in Great Britain.**—*Forestry* **27** no. 1 pp. 31–40, 16 refs. London, 1954.

The following is virtually the author's summary. Records of infestation of timber in Britain by *Hylotrupes bajulus* (L.) since 1934 [*cf. R.A.E.*, A **31** 144] are summarised according to locality and type, the great majority of buildings infested being in Surrey. Attack in buildings may be of long standing and extinct, or of more recent origin and usually active. Out of doors, living insects have been found in habitats ranging from dead parts of a standing Douglas fir (*Pseudotsuga taxifolia*) to a stack of sawn Scots pine (*Pinus sylvestris*). Active attack in packing-cases and crates of various origins has been recorded from different parts of the country. The possibility of spread of infestation is discussed and its effect examined in relation to the quality and dimensions of roofing-timbers in modern buildings.

Chaboussou (F.) & Moutous (G.). **Sur l'action larvicide de différents produits vis-à-vis du carpocapse de la prune** (*Laspeyresia funebrana* **Treit.**).—*Rev. Zool. agric.* **54** no. 10–12 pp. 101–110, 2 graphs, 12 refs. Talence, 1955.

Experiments on the control of *Cydia* (*Laspeyresia*) *funebrana* (Treitschke) on plum in south-western France [*R.A.E.*, A **44** 254] were continued in 1955, the treatments being directed against the second generation. Development was about a fortnight earlier than in the previous year [*cf. loc. cit.*], and some 95 and 99·5 per cent. of the eggs had hatched by 6th and 11th–12th July, respectively. Sprays were applied on 6th–8th July, when most of the larvae had already entered the fruits, and samples of the latter were examined on various dates between 19th July and 8th August. The results showed that very good control of the larvae in the fruits was given by an emulsion spray of 0·0225 per cent. parathion. This killed about 90 per cent. of the larvae in the first four instars, though older individuals that had penetrated to the centres were not affected. In addition, the spray prevented many larvae from entering the fruits and caused others to return to the surface, where they died. A wettable-powder spray affording the same concentration of parathion was rather less effective and emulsion sprays of 0·1 per cent. DDT or malathion were very inferior. The parathion emulsion spray is recommended and the date of application is discussed. Since the residues in the fruits have been shown to be negligible from the third day after application, the spray should not be applied until almost all the larvae have entered. This entails little dropping of infested fruits, for though larvae of the first generation feed near the peduncle and cause rapid fruit fall, those of the second generation feed in the pulp and dropping does not occur for some time.

Roussel (C.). **La tordeuse orientale du pêcher en 1955.**—*Phytoma* **8** no. 76 pp. 15–17. Paris, 1956.

Cydia molesta (Busck) is of importance on peach in France only in the regions of Marseilles, Bordeaux, Lyons and Toulouse, though it occurs almost throughout the country. The course of the infestation in these regions in 1955 is described, and it is shown that the weather was generally unfavourable for development. Near Marseilles, adults were taken in bait-traps from about 2nd May to 15th October. Damage to the shoots was considerable from 10th May. About 15 per cent. of the peaches were injured in Alpes-Maritimes and more than 20 per cent. in the Rhône Valley. Near Bordeaux, the principal flights occurred from 14th July to 12th August, 29th August to 13th September, and 16th September to 2nd October. Injury to peach began about mid-August, and pears and apples near peach trees were severely attacked towards the end of the season. Adults were taken near Lyons from 28th April to 10th June, 25th June to 30th August and 21st August to 13th September. Peach was slightly damaged by larvae of the first two generations, and late pears and apples by the third, injury to the pome fruits being frequently mistaken for that caused by *C. pomonella* (L.). Near Toulouse, infestation was more severe than in 1954, and there were four complete generations and a partial fifth. Adults of the overwintering generation were first taken in the field on 24th–28th April, and those of the first two generations on 25th May and in early July, respectively, after which there was considerable overlapping. Peach shoots were injured from mid-May, and the attack became more intense in mid-June and in August. About 15–20 per cent. of the peaches were attacked in July and about 70 per cent. in August, the fruits of very late varieties being completely destroyed where no control

measures were carried out. Losses of pome fruits were heavy in orchards near peach trees.

FARGEIX (A.). **Essais de produits antiparasitaires sur le doryphore de la pomme de terre en 1955.**—*Phytoma* **8** no. 80 pp. 23–24. Paris, 1956.

In a test against *Leptinotarsa decemlineata* (Say) on potato in central France in 1955, sprays containing endrin at the rate of 0·1 and 0·05 lb. per 100 gals. and unspecified arsenical dusts containing 3 and 5 per cent. arsenic were compared with a spray of 0·6 per cent. calcium arsenate. The overwintered adults appeared on 29th April, the first eggs were found on 15th May and the first larvae hatched on 8th June. Low temperatures and frequent heavy rains hindered development, and numbers were relatively low. The treatments were applied on 4th July. On 6th July, all the adults and almost all the larvae on the endrin-treated plots were dead, but larvae and some adults were still surviving on the other treated plots, and further counts on 9th and 13th July confirmed the superiority of endrin over the arsenical treatments. None of the products showed any toxicity to the eggs, and Coccinellids observed destroying the latter were not affected.

BLANCK (A.), MIQUEL (L.) & MOTEMPS (J.). **Lutte contre l'acariose de la tomate.**—*Phytoma* **8** no. 80 pp. 37–41, 2 figs., 2 graphs. Paris, 1956.

Experiments on the control of *Vasates lycopersici* (Massee) on tomato in the lower Rhône Valley [*cf. R.A.E.*, A **44** 37] were continued in 1955, when infestation began about 22nd August, developed rapidly and caused the complete collapse of untreated plants within 2–4 weeks. The treatments, which unless otherwise stated consisted of sprays, were applied on 24th–27th August and again on 9th–12th September. In addition to the products used in the previous year [*cf. loc. cit.*], toxaphene was tested at 0·15 per cent. and Kelthane (25 per cent. 1,1-bis(p-chlorophenyl)-2,2,2-trichloroethanol [also known as 4,4′-dichloro-α-trichloromethylbenzhydrol]) at 0·06 per cent. toxicant. A graph is given showing the average numbers of mites present per sq. cm. of leaf, on both upper and lower surfaces, from the sixth day after the first application; since the mites migrated from the leaves as soon as they withered, only leaves that were still green were examined. The numbers present six and (in brackets) 13 days after the first treatment were about 250 (14) for 0·06 per cent. PCPPCBS [p-chlorophenyl p-chlorobenzenesulphonate], 181 (29) for 0·15 per cent. malathion, 102 for a dust mixture of 80 per cent. sublimated sulphur and 3 per cent. malathion applied at about 27 lb. per acre, 64 (about 15) for 0·5 per cent. micronised sulphur, 61 (2) for toxaphene, 43 (6) for Kelthane, 38 (28) for 0·03 per cent. Chlorobenzilate [ethyl 4,4′-dichlorobenzilate] and 0·05 per cent. PCPPCBS, and 2·6 (2) for 0·038 per cent. Chlorobenzilate alone. The numbers continued to fall after the second application and did not exceed 11 on the 25th day after the first treatment, except for PCPPCBS, which permitted an increase to about 31 by the 30th day.

Since counting the mites was not considered a completely satisfactory method of assessing effectiveness, the fruits were removed and the aerial parts of the plants were weighed 35 days after the first application, the weights of the parts still green being expressed as percentages of the total. These percentages, in four repetitions, were 9·7–38·62 for Kelthane, 13·01–24·9 for toxaphene, 11·6–19·16 for Chlorobenzilate, 8·3–22·7 for micronised sulphur, 7·7–14·16 for the mixture of Chlorobenzilate and PCPPCBS, 5·6–8·86 for sulphur with malathion, 1·71–8·29 for malathion alone and 0·75–4·7 for PCPPCBS alone, as compared with 0·71–0·88 for no treatment.

It is concluded that Chlorobenzilate, Kelthane and toxaphene proved the most effective, followed by the sulphur products and malathion. As PCPPCBS is an ovicide, it will give good results only when eggs form the greater part of the population. The cost of the various treatments is discussed.

RÖNNEBECK (W.). **Erfolgsaussichten der chemischen Bekämpfung von Virusüberträgern im Kartoffelfeld.** [Prospects of Success in the chemical Control of Vectors of Potato Viruses.]—*Z. PflKrankh.* **61** pts. 3–4 pp. 113–129, 184–196, 1 fig., 21 refs. Ludwigsburg, 1954. (With a Summary in English.)

Field experiments were carried out in 1951–52 in north-western Germany on the efficacy of sprays containing Systox [diethyl 2-(ethylmercapto)ethyl thiophosphate (demeton)] in reducing the transmission of potato viruses by *Myzus persicae* (Sulz.). In an initial experiment in 1951 with two varieties of potato, one of them leaf-roll resistant, sprouted and unsprouted tubers were planted on 25th April and all the shoots had appeared above the soil by 25th May, when plants showing symptoms of secondary infection were removed. The first immigrant alates were observed on 20th May but numbers were insignificant until early June, and infestation by alates produced on the crop reached a peak on 10th July, the very dry summer affording optimum conditions for reproduction. Sprays of 0·25 per cent. Systox were applied on 2nd and 14th June and 1st and 11th July, and in order to permit the maximum action of the insecticide, they were applied twice each time at the high total rate of about 37 fl. oz. Systox per acre, the foliage being allowed to dry completely between treatments. Between 11th and 27th July, 1·8 times as many alates of *M. persicae* were caught in trap dishes in the sprayed as in the untreated plots, but counts made on 11th July before spraying and on each of the four following days showed the numbers of alates per 100 leaves in the treated and (in brackets) untreated plots to be 13 (111), 0 (38), 0 (26), 3 (34) and 0 (23), respectively. In laboratory tests in which leaves from the sprayed plots were placed individually in dishes and ten examples of *M. persicae* placed on each, the percentages of Aphids rendered inactive within 12 hours when exposed after four or 12 days to leaves sprayed on 2nd June were 98 and 14, respectively, and all Aphids were rendered inactive within an hour when exposed after one day to leaves sprayed on 11th July; apterae must therefore have been practically eliminated as vectors. The haulms of the test plants were removed on 11th or 28th July or left until harvest, and the seed tubers, the yield of which had increased with lateness of haulm removal, were planted in the following year and observed for virus infection. The results showed that the percentages of combined infection with leaf-roll and severe mosaic on sprayed plants of the leaf-roll resistant variety were 2, 3·1 and 14·9 for the three haulm treatments, respectively, when the original seed tubers had been sprouted before planting, and 2·5 and 5·8 for the last two haulm treatments when they had not, as compared with 7·9, 9·8, 16·6, 7·8 and 12·4 for unsprayed plants. On the other variety they were 2·3, 9·1 and 40·4 for sprayed plants from sprouted tubers given the three haulm treatments and 8·3 and 22·1 for those from unsprouted tubers given the last two haulm treatments, as compared with 17·7, 24, 32·1, 18·1 and 32 for unsprayed plants, respectively.

Similar results were obtained in four subsidiary tests in various localities in which Systox was used at more economic rates, and it is concluded that the sprays control the apterae sufficiently to prevent virus transmission by them, but not the summer alates [*cf. R.A.E.*, A **44** 283–284], and that the

haulms should be removed as early as economically possible to prevent the virus spread by the latter from reaching the tubers. The cost of the treatment is discussed at some length.

Häfliger (E.). **Zur Wirkungsweise von DDT-γ-HCH-Kombinationspräparaten.** [The Action of Combined Products of DDT and γ BHC.]—*Z. PflKrankh.* **61** pt. 3 pp. 139–143, 11 refs. Ludwigsburg, 1954. (With a Summary in English.)

The author briefly reviews the literature on the use of mixtures of DDT and BHC and gives the results of tests in Switzerland in which emulsified solutions of γ BHC, DDT or a 1:9 combination of the two were injected into the abdomen of adult cockchafers [*Melolontha melolontha* (L.)] at the rate of 1 cu. mm. per gm. body weight. The concentration was adjusted to give about 50 per cent. mortality, and the test insects, consisting of batches of 12 examples of each sex, were kept at 13, 20 or 27°C. [55·4, 68 or 80·6°F.] after treatment and provided with untreated food. Maximum mortality was usually reached in two days, and the results indicated that the median lethal dose in mmg. per gm. body weight for males and (in brackets) females at the three temperatures, respectively, were 0·9 (3·1), 0·8 (3·2) and 0·6 (2) for γ BHC, 7 (16), 11 (50) and 13 (64) for DDT, and 3·7 (13), 4·4 (18) and 4·6 (13) for the mixture. The values for the mixture approximated closely to those calculated on the assumption that the action of the ingredients is additive. The advantage of mixtures of BHC and DDT is that they compensate for the opposed temperature coefficients of the two insecticides [*R.A.E.*, A **41** 337, etc.].

Thalenhorst (W.). **Zur Kenntnis der Fichten-Blattwespen. II. Die Apparenzen der Nematini.** [Contributions to Knowledge of the Spruce Sawflies. II. The Time of Appearance of the Nematini.]—*Z. PflKrankh.* **61** pt. 4 pp. 196–202, 3 graphs, 10 refs. Ludwigsburg, 1954. (With a Summary in English.)

In this second part of a series [*cf. R.A.E.*, A **42** 183], the results are given of observations carried out in the Harz region of Germany in 1951–53 on the time of appearance of the Nematine sawflies that infest spruce. In each of the three years, adults of *Pristiphora ambigua* (Fall.) emerged first, towards the end of April, and were present for only a short time. They were followed at the beginning or middle of May by those of *Pachynematus scutellatus* (Htg.), *P. nigriceps* (Htg.), *Pristiphora saxeseni* (Htg.), *P. compressa* (Htg.) and *P. leucopodia* (Htg.), which usually persisted well into June. The adults of *Pachynematus montanus* (Zadd.) appeared about concurrently with those of the last-mentioned group but the females were sometimes earlier, and they were followed by those of *P. pallescens* (Htg.). Only one female of *Nematus insignis* (Htg.) was taken, in late May. Observations in 1952–53 showed that larvae of *Pristiphora ambigua* appeared at about mid-May and fed until early June. Those of the group of *Pachynematus scutellatus* were present during June and July, although in 1953 the larvae of *P. scutellatus* appeared in late May. Larvae of *P. montanus* were active from about 10th June until mid-August in 1952 and from late May until early July in 1953, and those of *P. pallescens* from late June until mid October in 1952 and from about 10th July until late September in 1953. The influence of weather, and particularly the date of thawing of the snow cover, is briefly discussed.

Attempts to rear the larvae in the laboratory were only partly successful, mortality being high. Of 41, 28 and 12 larvae of *P. scutellatus* that survived

in 1951, 1952 and 1953, respectively, 9, 1 and 1 entered diapause, and of 22 examples of *Pristiphora compressa* that survived in 1951 three also did so. No diapause occurred in *Pachynematus montanus*, *P. pallescens* or *Pristiphora saxeseni*.

Data on *Pristiphora abietina* (Christ) in north-western Germany [*cf. loc. cit.*] were too scanty for direct comparisons with any of the Harz species to be drawn.

Zoebelein (G.). **Versuche zur Verwendung von " Ersatzwirten " bei Laborzuchten der Zehrwespen *Microplectron fuscipennis* Zett. (Chalcididae, Eulophinae) und *Pteromalus alboannulatus* Ratz. (Chalcididae, Pteromalinae).** [Experiments on the Use of alternative Hosts in the Laboratory Rearing of *Dahlbominus fuscipennis* and *Dirhicnus alboannulatus*.]—*Anz. Schädlingsk.* **28** pt. 5 pp. 65–67, 12 refs. Berlin, 1955.

During investigations in Germany on the bionomics of *Dahlbominus* (*Microplectron*) *fuscipennis* (Zett.) and *Dirhicnus* (*Pteromalus*) *alboannulatus* (Ratz.), which parasitise the cocoon stages of *Diprion* spp. and the pupae of *Panolis flammea* (Schiff.), respectively, the supply of these natural hosts became exhausted and experiments were undertaken to establish whether they could be reared on other insects. *Dirhicnus* was reared on pupae of *Boarmia bistortata* (Goeze), *Ellopia prosapiaria* (L.), *Bupalus piniarius* (L.), *Ematurga atomaria* (L.) and *Sphinx pinastri* L., the numbers of males and (in brackets) females of the parasite obtained per host pupa averaging 10·5 (34·8), 8 (23), 4·5 (24), 7·7 (15·8) and 48 (271), respectively, as compared with 8·8 (43·2) for *Panolis flammea*, and there appeared to be a direct relation between the size of the host pupa and the number of parasites that emerged from it. Females reared from any of these hosts readily oviposited in *P. flammea*. Pupae of *Dendrolimus pini* (L.) and *Dasychira pudibunda* (L.) that had been removed from their cocoons were not attacked.

Dahlbominus fuscipennis reproduced to some extent in *Pristiphora abietina* (Christ) (*Lygaeonematus abietum* (Htg.)), provided that the ratio of females to cocoons was high, and maintained itself for four generations on this host, but evidently did not become adapted to it. *P.* (*L.*) *wesmaeli* (Tischb.) proved more favourable, even permitting an increase in numbers, and some adaptation to it appeared to have occurred by the fourth generation. Females reared on *P. abietina* or *P. wesmaeli* oviposited normally in cocoons of *Diprion* spp., and in a field experiment in which lots of ten females reared on *Diprion* spp., *P. abietina* and *P. wesmaeli* were caged with ten cocoons of each of the three hosts, one cocoon of *P. abietina*, two of *P. wesmaeli* and eight of *Diprion* were parasitised, the numbers of males and (in brackets) females that emerged being 9 (0), 14 (29) and 104 (299), respectively.

Hanspeter (A.). **Auftreten von *Chloroclystis rectangulata*.** [An Occurrence of *C. rectangulata*.]—*Pflanzenschutzberichte* **13** pt. 7–8 p. 112. Vienna, 1954.

Chloroclystis rectangulata (L.) is recorded for the first time in the Tyrol, on fruit trees near Innsbruck.

Ivanchenko (A. V.). **The Effect of Temperature on the Duration of the toxic Action of Hexachlorane.** [*In Russian.*]—*Dokl. vsesoyuz. Akad. sel.-khoz. Nauk Lenina* **20** no. 6 pp. 26–28, 7 refs. Moscow, 1955.

In view of the divergent results obtained by workers in the Soviet Union on the duration of the toxicity of BHC applied against agricultural pests,

periods ranging from two days to several years being recorded, the effect on it of the humus content and pH of the soil and of temperature were investigated. The tests on humus content were carried out in two plots of clay soil, of which the humus content was 2·13 and 0·41 per cent., respectively. A dust of 12 per cent. BHC was applied to each plot at the rate of 0·9 oz. per sq. yard and harrowed in to a depth of 2 ins., and first-instar *Phylloxera* nymphs were introduced to a depth of 8 ins. after a fortnight. The temperature fluctuated between 21 and 24°C. [69·8–75·2°F.], and all the nymphs died, indicating that toxicity had been maintained in both types of soil. In the tests on pH, glass tubes a little over one inch in diameter were filled with medium clay soil having a natural or adjusted pH of 3·7, 6·9 or 7·6, and the BHC dust was applied at the same rate and again mixed with the soil to a depth of 2 ins. Some of the tubes were then kept in the laboratory at 21–24°C. for two months, and some were sunk into the soil outdoors for about three months in a site exposed to the sun, the temperature of the upper soil layer fluctuating between 18 and 46°C. [64·4–114·8°F.]. All *Phylloxera* nymphs exposed to the treated soils after storage in the laboratory died, as also did those exposed to the soils of pH 3·7 or 6·9 left outdoors, but the soil with pH 7·6 exposed outdoors caused no mortality.

The effect of temperature on the vaporisation of BHC was tested by soaking small disks of filter paper in a saturated solution of γ BHC in ethylene dichloride, air-drying, and exposing them to currents of air ranging in temperature from 15 to 55°C. [59–122°F.]. The weight differences before and after exposure showed that the rate of vaporisation increased rapidly with temperature, being 21 and 227 times as great at 25°C. [77°F.] and 55°C. as at 15°C. It is concluded that the loss of BHC following dusting or spraying is largely due to vaporisation, which occurs in direct proportion to temperature. Prolonged effectiveness should not be expected in the south of the Soviet Union, whereas even very low dosages may have a prolonged action in the north.

Bobinskaya (S. G.) & Persin (S. A.). **The Effect of ecological Conditions on the Development of the Plants and on their Toxicity to the Beet Weevil when Hexachlorane is introduced into Soil under Sugar Beet.** [*In Russian.*]—*Dokl. Akad. Nauk SSSR* **105** no. 6 pp. 1350–1353, 2 graphs, 4 refs. Moscow, 1955.

In experiments near Kiev, sugar beet was sown in containers filled with soil the moisture content of which was 30 or 60 per cent. of saturation, a mineral fertiliser being added to one series at the higher moisture content. In some containers the seeds were first dusted with 12 per cent. BHC in the proportion of 1 : 10 by weight, and in others the dust was mixed with the soil at the rate of 0·015 per cent. by weight of air-dried soil before sowing. The results were estimated two months later, when it was found that both the BHC treatments reduced the area of leaf surface, the weight of dry matter and the yield of beets and leaves under conditions of low moisture content and increased them under high moisture conditions, particularly when the fertiliser was added. The toxicity of the leaves to the beet weevil [*Cleonus punctiventris* (Germ.)] was tested by confining 40 adults in each of the containers one or six days after the plants had sprouted and counting the survivors two weeks later. The results showed that the percentage mortality increased from 26·3 and 15 for seed treatment and soil treatment with BHC, respectively, at the low soil humidity to 42·1 and 31·6 at the high humidity without fertiliser and to 50·2 and 36·5 at the high humidity with the fertiliser, as compared with no mortality in the absence of BHC. The greater toxicity of the plants under the better growing conditions is

apparently due to their greater absorption of solutes, including toxicants, from the soil.

ROONWAL (M. L.). **The natural Establishment and Dispersal of an imported Insect in India—the Lantana Bug,** *Teleonemia scrupulosa* **Stål (= *lantanae* Distant; Hemiptera, Tingidae), with a Description of its Egg, Nymphs and Adult.**—*J. zool. Soc. India* **4** no. 1 pp. 1–16, 4 figs., 1 map, 27 refs. Calcutta, 1952.

Although it had been decided not to liberate *Teleonemia scrupulosa* Stål in India for the control of *Lantana camara* (*aculeata*) in view of the possible danger to teak [*cf. R.A.E.*, A **34** 287, etc.], and the laboratory stocks had been destroyed in 1943, an example was taken on *L. camara* near Dehra Dun in 1951 and further investigations showed that the Tingid had become established in several places in the area, individuals being taken as far away as 26 miles from the laboratory in which the rearing had been carried out. It is concluded that some of the laboratory stock must have escaped [*cf.* also **42** 366]. Though averages of up to 17 adults were taken per *Lantana* bush, there were no signs of infestation on teak or on the undergrowth in a plantation in the area. All stages of *T. scrupulosa* are described, and its bionomics in India are briefly reviewed. It has 10–11 overlapping generations a year at Dehra Dun.

WILLIAMS (J. R.) & MAMET (J. R.). **Insects and other Invertebrates which feed upon Sugarcane in Mauritius and Réunion, and their natural Enemies.**—*Bull. Dep. Agric. Mauritius* no. 89 [3 +] 19 pp., 73 refs. Port Louis, 1954.

Separate lists are given of the insects that attack sugar-cane in Mauritius and Réunion, based on published and unpublished information up to 1954 and showing their parasites and predators, followed by notes on doubtful or erroneous records.

YASUMATSU (K.). **Some Considerations on the reproductive Capacity of a Kyushu Race of** *Anicetus ceroplastis* **Ishii, an effective Parasite of** *Ceroplastes rubens* **Maskell in Japan.** [*In Japanese.*]—*Sci. Bull. Fac. Agric. Kyushu* **14** no. 1 pp. 7–15, 14 refs. Fukuoka, 1953. (With a Summary in English.)

The following is based on the author's summary. Investigations on the natural mortality of the Coccid, *Ceroplastes rubens* Mask., in Japan in 1951 showed that about 20 per cent. of the crawlers failed to become established, that about 50 per cent. mortality from causes other than parasites and predators occurred after settling and in the early second instar, even under favourable conditions, and that about 30 per cent. of the remaining scales died during autumn, winter or spring without producing eggs. It is concluded that the 500–700 eggs deposited by each female give rise to only 140–196 adult offspring, apart from attack by natural enemies. *C. rubens* is parasitised in Kyushu by *Anicetus ceroplastis* Ishii, and tests showed that females of this Encyrtid deposit up to 400 eggs each under favourable conditions, but appear to be unable to distinguish parasitised from unparasitised Coccids, so that superparasitism occurs; only one parasite larva survives in each host. Fertilised and unfertilised females oviposit equally readily, the former giving rise to equal numbers of males and females and the latter to males only. Five fertilised females laid an average of about five eggs a day. Parasite activity was normal at temperatures below 25°C. [77°F.], but higher

temperatures were unfavourable. Adults of *Anicetus* feed on the honeydew excreted by Coccids and Aphids, and survived for several months when honey was available in the laboratory. The Encyrtid is not attacked by secondary parasites. The females have the power of oösorption, and adults of the first generation can therefore be liberated in the field without artificial measures to hasten or delay emergence.

YASUMATSU (K.). **Preliminary Investigations on the Activity of a Kyushu Race of *Anicetus ceroplastis* Ishii which has been liberated against *Ceroplastes rubens* Maskell in various Districts of Japan.** [*In Japanese.*] —*Sci. Bull. Fac. Agric. Kyushu* **14** no. 1 pp. 17–26, 1 map, 11 refs. Fukuoka, 1953. (With a Summary in English.)

The following is based on the author's summary. The Kyushu race of *Anicetus ceroplastis* Ishii [*cf.* preceding abstract], was found in 1946 and was liberated in large numbers in 1948–52, particularly in Honshu and Shikoku, for the control of *Ceroplastes rubens* Mask., a serious pest of *Citrus*, persimmon and tea. Field observations in the four years showed that the parasite was increasing in numbers in all areas and giving commercial control of the Coccid near the liberation points within 3–4 host generations, so that it was effective in the sense of Clausen [*cf. R.A.E.*, A **39** 262]. Increasing the size of the colonies liberated reduced the time taken to obtain commercial control, but in some localities parasitism remained low, possibly owing to unfavourable conditions such as the dense growth of the trees and an abundance of sooty mould on them, which appeared to provide an unsatisfactory environment. The application of resin wash, nicotine sulphate or lime-sulphur against the Coccid did not appear to reduce parasite populations so much as had been expected, and spraying to reduce scale populations and to remove the sooty mould, together with adequate thinning of the trees before parasite liberation, is advised. Although the females of *Anicetus* appear sluggish, the parasite dispersed over distances of up to a mile and a quarter within two years, and observations over four years revealed no instance in which the parasite failed to establish itself in Honshu or Shikoku.

YASUMATSU (K.) & YAMAMOTO (S.). **Comparisons on the reproductive Capacity among *Anicetus ceroplastis* Ishii reared from *Ceroplastes rubens* Maskell feeding on different Host Plants.** [*In Japanese.*]—*Sci. Bull. Fac. Agric. Kyushu* **14** no. 1 pp. 27–33, 16 refs. Fukuoka, 1953. (With a Summary in English.)

The following is based on the authors' summary. In investigations carried out in Japan to determine whether the food-plants of *Ceroplastes rubens* Mask. indirectly affect its parasite, *Anicetus ceroplastis* Ishii, particularly by modifying its reproductive capacity, species of *Citrus*, *Eurya*, *Sakakia*, *Ternstroemia* and *Ilex* had no effect, differences in reproductive capacity and survival of the adults depending exclusively on their size. Parasites that developed in *Ceroplastes* on various plants in Kyushu were equally effective in liberations against the Coccid in Honshu and Shikoku [*cf.* preceding abstract].

SIMMONDS (F. J.). **Establishment of Parasites of *Diatraea saccharalis* F. in Dominica (British West Indies) and Guadeloupe (French West Indies).** —*Trop. Agriculture* (*Trin.*) **32** no. 3 pp. 198–200, 2 refs. London, 1955.

During a visit to Dominica in November 1951, the author observed *Diatraea saccharalis* (F.) attacking 20–30 per cent. of the joints of half-grown sugarcane in fairly large plantations at Grand Savannah and Bagatelle, situated

in dry and wet areas of the island, respectively. As none of the larvae collected yielded parasites, adults of *Lixophaga diatraeae* (Tns.) and *Paratheresia claripalpis* (Wulp) were forwarded from Trinidad and released in both areas between November 1951 and January 1952. Infestation by *Diatraea* did not exceed 5 per cent. when observations on the establishment of the parasites were made in 1954. Parasitism was high in small collections of larvae made at Bagatelle in June–July, *Paratheresia* being more numerous than *Lixophaga*. In July, a further collection of 82 larvae was made near Bagatelle, about three miles from the nearest point at which the parasites had been liberated. Puparia of *Paratheresia* were obtained from 48 of these, a cocoon of *Agathis stigmatera* (Cress.) which had not been previously recorded from Dominica, from one, and pupae of *Diatraea* from seven; the remainder died. *A. stigmatera* was again reared from *Diatraea* larvae in November, together with *Paratheresia*. Both *Lixophaga* and *Paratheresia* had thus become established, but *Lixophaga* did not appear to have spread as quickly as *Paratheresia*. *Metagonistylum minense* Tns. was released in November 1954, but it was not known whether it would become established in view of the decrease in attack by *Diatraea* and the competition from the other parasites.

P. claripalpis was released against *D. saccharalis* in Guadeloupe [*cf. R.A.E.*, A **44** 222] in February 1954, and one puparium was found in August. The parasite thus appears to be at least temporarily established, although the annual rainfall of the area is only 40 ins., which is considered to be rather low for this species.

Burkhardt (C. C.) & Painter (R. H.). **Weight Differences in Southwestern Corn Borer Larvae, *Diatraea grandiosella* Dyar, reared on Teosinte in Kansas in 1952.**—*J. Kans. ent. Soc.* **27** no. 1 pp. 21–23, 1 fig., 1 ref. Manhattan, Kans., 1954.

The following is virtually the authors' summary. Highly significant differences in the weights of larvae of *Diatraea grandiosella* Dyar were recorded when the larvae were reared on different plants of teosinte (*Euchlaena mexicana*) in Kansas. No significant differences were found between weights of larvae from the same plant. On maize, only one larva normally matures per plant, but wide differences in weights of individual larvae on single plants have been observed. The differences in weight among groups of larvae that have fed on individual plants of maize may also be highly significant, and represent inherent resistance.

Smith (R. C.) & Franklin (W. W.). **The Garden Webworm—*Loxostege similalis* Guen. as an Alfalfa Pest in Kansas.**—*J. Kans. ent. Soc.* **27** no. 1 pp. 27–38, 7 figs., 8 refs. Manhattan, Kans., 1954.

The following is based on the authors' summary of this account of observations on the bionomics and control of *Loxostege similalis* (Gn.) on lucerne in Kansas over 32 years. The moth does not overwinter in the State but migrates from the south each year and oviposits there. Severe outbreaks occurred in 1923, 1934, 1949 and 1951. Larvae of three successive generations appear on lucerne, in early May, early July and September–October, respectively, though the third [illegible] until the onset of heavy frosts. All stages are briefly described, and a list is given of the cultivated and wild plants infested during the outbreak in 1923. Lucerne appears to be the preferred food-plant. The most severe outbreak occurred in 1951, when lucerne of the second and third cuttings over large

areas was completely destroyed. The best control was given by dusts of DDT, toxaphene, dieldrin, Metacide [methyl-parathion and parathion] and parathion, this last being the most rapid in action. DDT gave better control and a higher yield of seed at 2 than at 1 lb. per acre, and applications when the plants were 6–8 ins. high and again at the bud stage of development resulted in higher yields than did applications at the bud stage alone or when the plants were 6 ins. high. Increases in seed yield were partly due to control of other insects. DDT at 2 lb. per acre, applied when the first webs appear, is recommended.

BALLARD (R. C.). **The Biology of the predacious Mite *Typhlodromus fallacis* (Garman) (Phytoseiidae) at 78°F.**—*Ohio J. Sci.* **54** no. 3 pp. 175–179, 4 refs. Columbus, Ohio, 1954.

Typhlodromus fallacis (Garman) caused serious losses among cultures of *Tetranychus telarius* (L.) (*bimaculatus* Harvey) in Ohio in 1952, and observations were made on its bionomics. It was reared in the laboratory at an average temperature of about 78°F. and a relative humidity of about 95 per cent., and adult males of *T. telarius* were provided as food. The egg and larval stages averaged 46·1 and 15·4 hours, respectively, and the protonymphal and deutonymphal stages (the last occurring in the females only) 32·6 and 26·3 hours. Adults survived for an average of over 36 days. Pairing occurred almost immediately after the adult stage was reached, and there was a preoviposition period of about 24 hours. Females oviposited at the average rate of 2·2 eggs per day over a period of about 22 days. Unfertilised females did not oviposit. Adult males and fertilised and unfertilised females destroyed averages of 3·9, 8 and 4 males of *Tetranychus* per day, respectively, and the protonymphs and deutonymphs averages of 4·8 and 6·6. The larvae were not observed to feed. The mites attacked examples of their own species under starvation conditions, but did not feed on green plant material.

BUSVINE (J. R.). **Simple Methods for rearing the Cricket (*Gryllulus domesticus* L.) with some Observations on Speed of Development at different Temperatures.**—*Proc. R. ent. Soc. Lond.* (A) **30** pt. 1–3 pp. 15–18, 1 graph, 8 refs. London, 1955.

The author describes techniques by means of which a colony of *Acheta* (*Gryllulus*) *domesticus* (L.) was maintained in the laboratory for five years. Both adults and nymphs were kept in open glass containers of appropriate size containing a layer of dry sand at the bottom and pieces of folded cardboard for shelters. A proprietary meal made up for laboratory animals and based on cereals with the addition of proteins and vitamin-containing substances was provided as food and supplemented about once a week with fresh cabbage, lettuce or other leaves. A pad of cotton-wool kept moist by means of an inverted tube of water afforded both a water supply and a suitable oviposition site. The eggs were incubated on small blocks of plaster standing in water and covered with glass cylinders to prevent the nymphs from escaping; the eggs often became covered with moulds, which, however, appeared to be harmless. Constant temperatures of 77–95°F. were satisfactory. The minimum incubation and total development periods occupied 11–13 days and 35 days, respectively, at 95°F. The total development period was extended to 40–41 days at 104°F. and to 165–238 days at 73·4°F., at which the incubation period lasted 46–51 days. There appeared to be no diapause during the egg stage.